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the OIL AND GAS JOURNAL

FEBRUARY 9, 1959

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IN OIL AND GAS PRODUCTION....

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2. Building a closed-system adsorption-type unit
3. Hydrocarbon-recovery units and low-temperature separators
4. Low temperature processing is popular process
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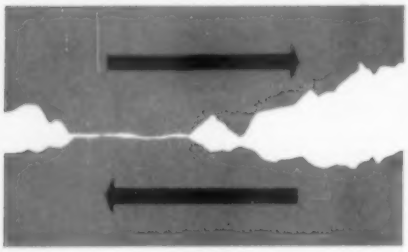
Beginning on p. 97

WHY VALVE LUBRICATION SAVES MONEY

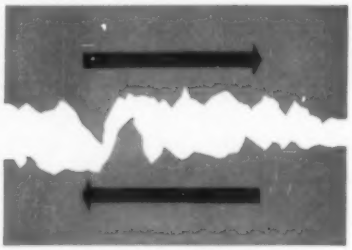
TROUBLE STARTS WHEN METAL RUBS METAL...

Under the microscope, metal that appears mirror-smooth to the naked eye shows as sharp mountains and deep valleys. This roughness, combined with the heat and pressure of metal-to-metal rubbing, causes valve trouble in the following ways:



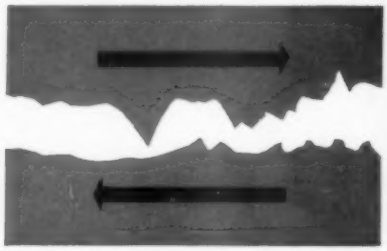
STICKING

"Cold Welding" occurs when friction or pressure welds the peaks together. The result: sticking.



SHEARING

The "hills" of one surface gouge into the hills of the other surface causing further sticking and scoring.

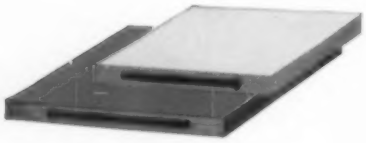


PLOWING

If one surface is even slightly harder than the other, the hard peaks act like a "plow". Leakage soon results.

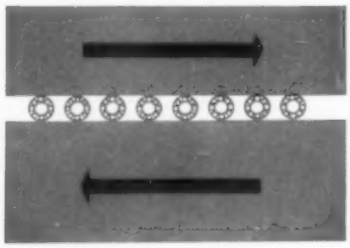
BUT, WITH ROCKWELL-NORDSTROM VALVE LUBRICATION...

metal-to-metal contact is eliminated. Here's what happens when metal-to-metal surfaces are lubricated:



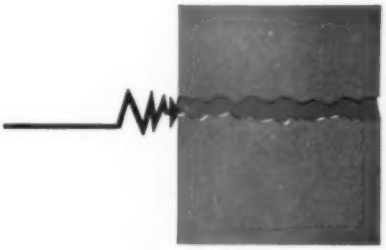
SLIDING

Lubricant prevents friction heat, eliminating danger of cold welding and assuring easy movement.



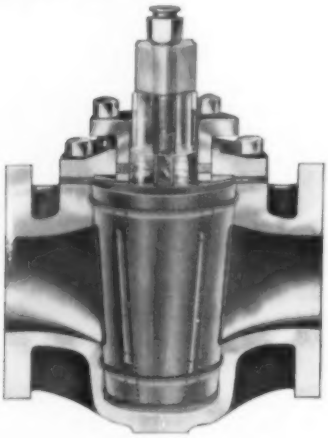
ROLLING

Lubricant becomes millions of tiny bearings . . . metal surfaces actually never come into contact with one another.



SEALING

Pressurized lubricant forms an impenetrable, continuous seal against leakage.



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the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Feb. 9, 1959

Oil men suddenly are interested in their steel needs:

Scare buying of steel by other major industries fearing a midyear steel strike has made big oil companies take a look at their tubular-goods inventories (p. 61).

Buying for oil-country needs has picked up.

Here's the situation:

Some big companies have ordered now for second quarter, a few for third quarter and at least one for the whole year. Supply people expect big users generally soon will order their tubular goods through third quarter for first half delivery.

Smaller users have contacted their suppliers and will depend on them to protect in case midyear steel strike tightens the market.

Suppliers advise sensible buying, warn inventory hoarding will jam distribution channels now and mean a "feast to famine" situation for them later.

▼ ▼ ▼

A faster moving trial seems assured in Tulsa on government price-fixing case against 29 oil companies.

All but one of the indicted firms have agreed to waive a trial by jury. The decision must be unanimous, but the holdout company is expected to go along with the others. This will permit Federal Judge Royce Savage to try the case alone.

Filing the official jury waiver, however, will be delayed to make sure Savage will be on the bench. Trial probably will get started in the fall.

▼ ▼ ▼

Crude-price changes are continuing.

Seven more major buyers have joined in cutting 7 cents a barrel off the price of West Texas-New Mexico crudes. They are Indiana Oil Purchasing, Texaco, Magnolia, Sinclair, Phillips, Humble, and Sun, which together buy nearly 1,000,000 bbl. daily in the region. The actions mean nearly all of Permian basin oil now moves at lower prices.

The 10-cent cut for Four-Corners area also shows signs of sticking. Shell has posted the cut on some 20,000 bbl. daily there, meeting an earlier move by competitors.

Colorado and Montana crudes also were involved in lower postings by Phillips. Company reduced Rangley crude 10 cents to $3.05 top and Cut Bank crude 17 cents to a $2.98 top.

▼ ▼ ▼

A 25-cent hourly pay boost has been won by operating engineers working on Louisiana pipeline projects.

Strike by the engineers had shut down 10 construction jobs in the state. Pipe Line Contractors Association agreed to the increase to $2.80 an hour after the union guaranteed no further work stoppages.

Rates will now be negotiated for 16 other states where pipeline contracts exist.

▼ ▼ ▼

North Dakota exploration is off to a fast start in 1959.

In year's first month, 10 new fields and important extensions have been recorded (p.147). Operators last week announced 18 new locations.

Current drilling activity is centering in Burke County which had seven important discoveries last year. Big push now is in followups and stepouts from these.

A long-awaited confirmation to last year's Wind River-Tertiary oil strike at Lost Cabin field in Wyoming's Wind River basin has been announced by The California Co.

Well is the 2 Government in 10-38N-90W, Fremont County. It flowed 153 bbl. on ¼-in. choke from formation at 3,300-3,400 ft. It gives the green light to shallow exploratory activity on the complex north side of the basin.

Northwestern Oklahoma adds to its gas stature.

Pan American has completed 1 Shattuck Operating Unit in Ellis County, showing 23,750 M.c.f. daily from Pennsylvanian Morrow sand at 9,088-94 ft.

Well opens the county's eighth gas and gas-condensate field within a year.

Hazards of offshore drilling are underscored by damage to California's only mobile drilling platform last week by freakish Pacific waves.

"Pacific Driller" of Off Shore Constructors was the victim. It had completed drilling first wildcat on Texaco-Monterey-Newmont lease offshore from Santa Barbara County and was preparing to move 10 ft. for a second test.

Operators started pulling $2-million barge off bottom. But when the eight legs had been jacked up a few feet, huge waves struck and within minutes broke off four of the 6-ft. diameter caisson legs. It was towed to Long Beach for repairs.

Workers, meanwhile, last week continued to patch the hull

of a sunken platform in the Gulf of Mexico before refloating it for Trans-Gulf Offshore Drilling.

Legal attack on small-tract drilling in Texas has suffered setback in Austin district court.

Judge upheld validity of drilling permit issued by Railroad Commission to independent for well on 1/5-acre tract. The other operators in Normanna gas field of Bee County had sought to nullify the permit (p. 64).

Operators still have suit pending to upset basis for setting gas allowables for small tracts in Normanna field. Victory in this suit could discourage small-tract drilling.

▼ ▼ ▼

Outlook for detergent sales is dimming for processors.

Near saturation of the market exists, according to O.V. Tracy of Esso. Synthetics are stabilizing at about 73% of the soap-detergent market.

This means dramatic growth period is over. Modest gains only are in sight for soap. It will be geared to increase in consumer total demands.

Emphasis in future will be on improved detergents--and competition will be intense for new products.

Solvent markets face another blow. Water-emulsion paints are ready to invade the outdoor market.

A polyvinyl acetate emulsion paint now promises to do for the outside what styrene butadiene latex has done inside.

Paint thinner loses out with these new coatings. And refiners already familiar with the impact indoor paints made on solvent sales are looking around for alternative markets.

Oil movement by tanker has picked up sharply.

Tonnage laid up has dropped from 6,129,672 in early July 1958 to 3,760,234 tons in mid-January.

Number of laid up U. S. tankers has been cut by half and foreign lay ups by one-third.

Heating-oils market is getting extremely tight. It could get worse if frigid weather continues and strikes spread.

Coldest weather in years has boomed demand, firmed up the prices of kerosine, distillates, fuel oil. Mid-Continent and Gulf Coast refiners report supplies growing tight. Coastal refineries are nearly sold out through February (p. 66).

Strikes at Gulf's Port Arthur and Shell's Wood River plants are aggravating situation, even tightening up gasoline market. New York harbor tug strike also may have damaging effect on deliveries in that region. Any new refinery strikes could put a squeeze on marketers and suppliers alike.

The fuel cell offers some intriguing and promising long-

range possibilities that the oil man can't overlook.

Lab work is under way among several companies on the idea.

The cell is a competitive source of energy for oil and yet is a potential consumer of petroleum products. Researchers probably are still a number of years away from a practical model (p. 72).

▼ ▼ ▼

Gasoline-tax increases are in prospect for four more states: Massachusetts (½-cent), Missouri (2 cents), Oregon (1 cent), and West Virginia (1-cent).

Governors of 29 states, meanwhile, have added their voices to growing protest over President Eisenhower's call for a 1½-cent jump in the federal gasoline tax.

California's tideland-oil income may be used to help finance a $658-million state water development plan.

Governor Brown proposes that $38 million be appropriated immediately from the oil fund and the entire fund be pledged to the water program. The fund will total $158 million by midyear. A $500-million bond issue would raise the balance of the water financing.

Proposal to reorganize the territorial Alaskan government also will interest oil men.

A Chicago management firm suggests that an oil and gas section be set up under a department of natural resources which also would have a mineral division and a registry section.

Oil and gas section would replace present Oil and Gas Commission. It would approve and administer oil and gas leases, inspect wells, enforce conservation measures, etc.

▼ ▼ ▼

The Washington scene:

Depletion allowance has the public support of Treasury Secretary Anderson who upheld the practice in an appearance before House appropriations committee.

Imports program may be taken out of hands of administration. Senator O'Mahoney will grab the initiative with a bill to reduce sharply flow of both crude and products, including residual. It'll be angled for coal-state support.

Sale of Florida offshore leases may be postponed by the Government. The California Co. is only firm to show an interest in 346,600 acres before deadline. Bureau of Land Management, however, may consider late nominations.

Exploration on San Nicolas Island off California coast has opposition of Pentagon. Defense officials object to oil and gas activity either by private companies or Navy. Bill now before Congress would turn island over to Navy as part of a new petroleum reserve.

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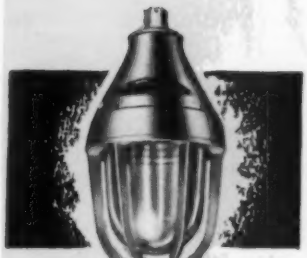

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TECHNOLOGY—OPERATION

Refining-Processing

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By A. W. Francis

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By J. Roger Heumann

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Formulating a Linear-Programing Model for Refinery Simulation 101

By Charles R. Nichols

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What It Takes to Make a Multiple, Tubingless Completion 100

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Humble has cemented two or three strings of 2⅞-in. o.d. pipe in open hole. Location is Raccoon Bend field of Austin County, Texas.

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What's New in Mud-Logging Techniques . . 116

By John G. Caran and Sam H. Caran

Spectrometric gas analysis was successfully employed on the second-deepest well in the world to identify hydrocarbon gases in the mud stream and drill cuttings. The well was Shell Oil's 5 Rumberger in Elk City field, Beckham County, Oklahoma.

Pipelining

Double Pipelines Move "Solid" Oil 112

A 3-in. defroster line containing 180° water is buried in contact with an 8-in. crude line in Sumatra's Lirik field. This is to prevent oil temperature from dropping 105° F. It solidifies below this point.

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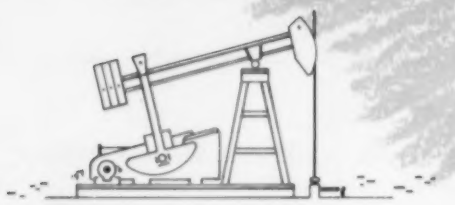

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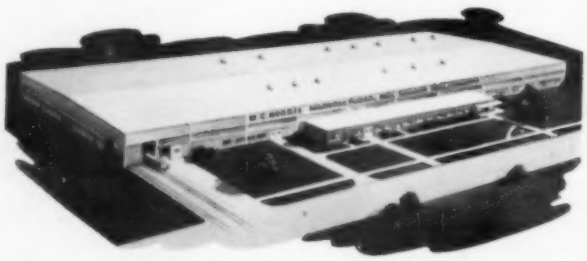

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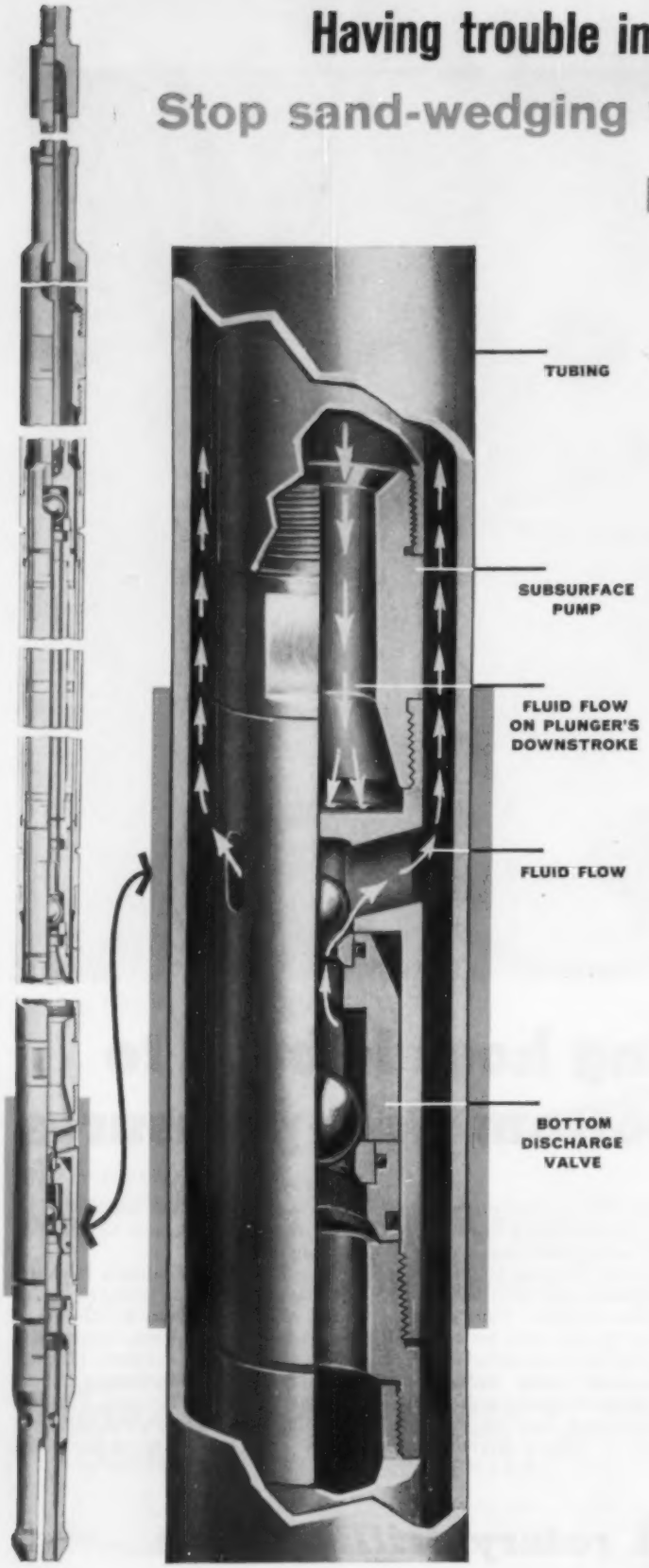

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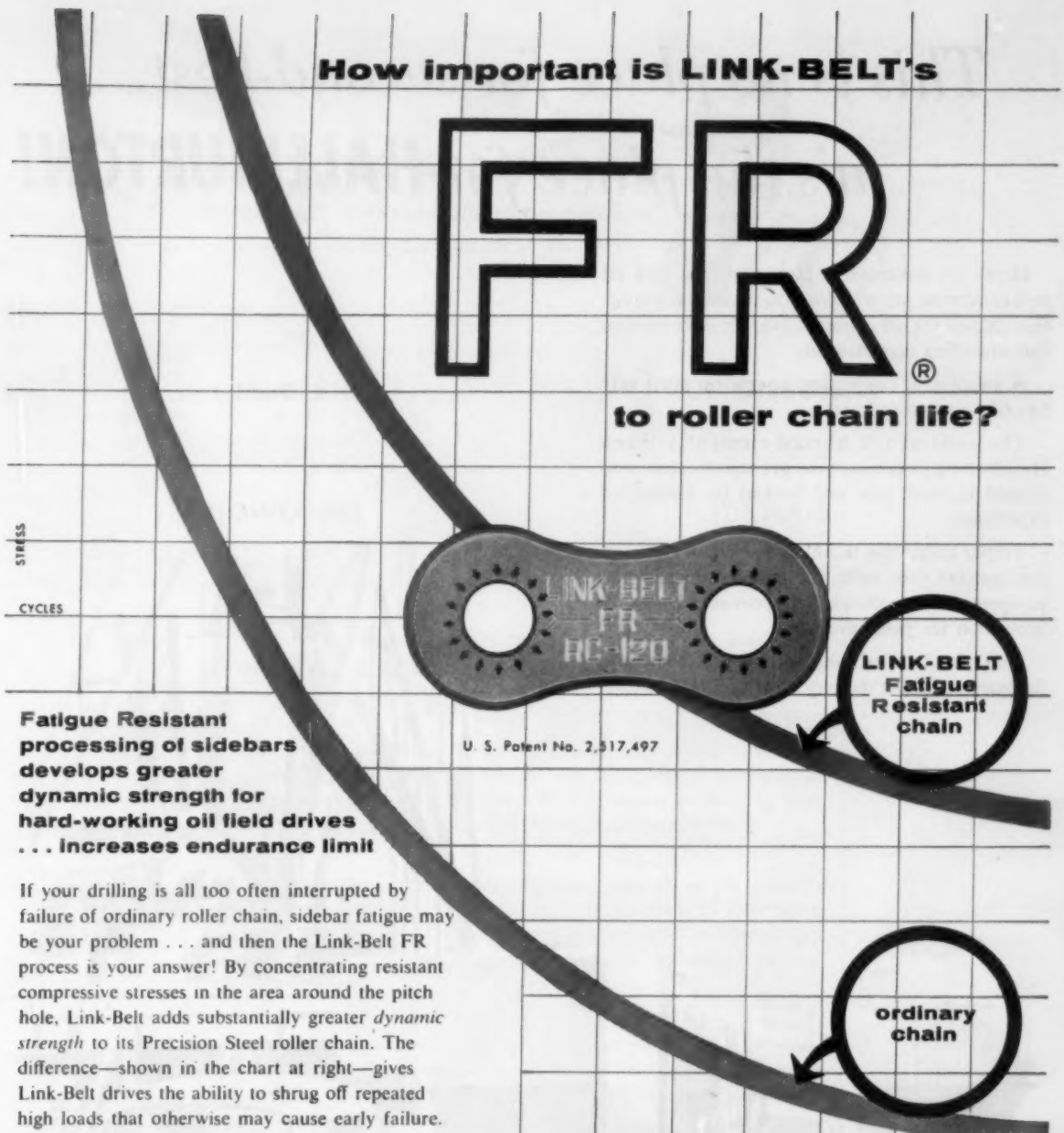
Export Office—30 Rockefeller Plaza, New York 20, N. Y.

How important is LINK-BELT's FR® to roller chain life?



U. S. Patent No. 2,517,497

Fatigue Resistant processing of sidebars develops greater dynamic strength for hard-working oil field drives . . . increases endurance limit

If your drilling is all too often interrupted by failure of ordinary roller chain, sidebar fatigue may be your problem . . . and then the Link-Belt FR process is your answer! By concentrating resistant compressive stresses in the area around the pitch hole, Link-Belt adds substantially greater *dynamic strength* to its Precision Steel roller chain. The difference—shown in the chart at right—gives Link-Belt drives the ability to shrug off repeated high loads that otherwise may cause early failure.

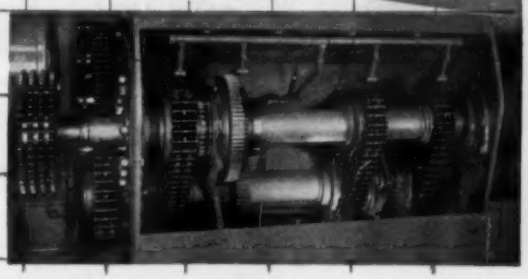
Standard on Link-Belt oil field roller chain, FR is supported by many more "extras." Any leading supply store in the field will gladly explain their importance, and furnish you a copy of Link-Belt Catalog 2780.

14,690

LINK-BELT

ROLLER CHAINS & SPROCKETS

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 21, Odessa, Tex., Shreveport, La., Los Angeles 33, Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields.



NATIONAL SUPPLY 80-B DRAWWORKS is equipped with Link-Belt FR roller chain for extra dependability. Other important Link-Belt roller chain extras:

- SHOT-PEENED ROLLERS with greater fatigue life.
- PRE-STRESSING for load-bearing uniformity.
- E-Z ASSEMBLY to facilitate field installation.
- SHEPHERD'S CROOK COTTERS—won't shake loose.
- DOUBLE BOXING—most effective in the field.

This is no place for second-best...
it's the place for **HALLIBURTON!**

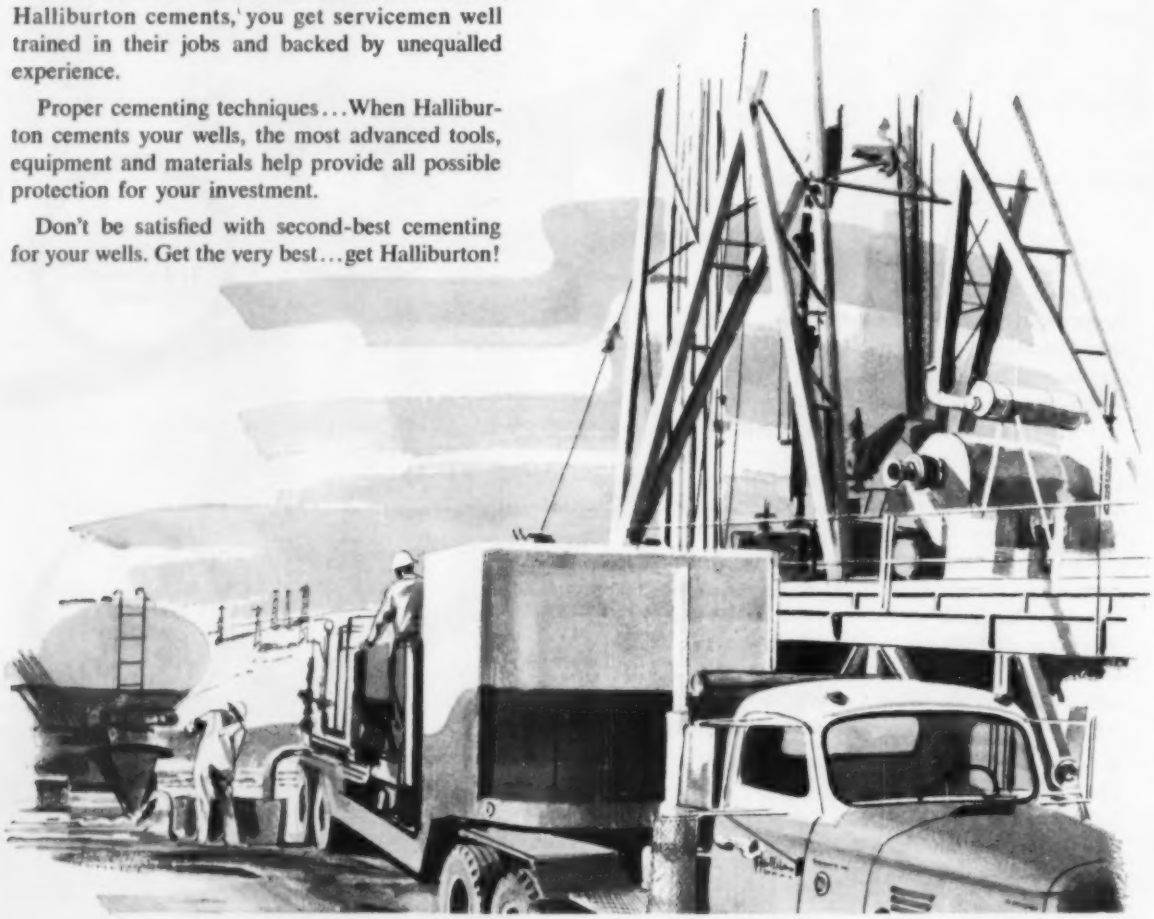
Here's an indisputable fact: Only the best oil well cementing job will give you maximum protection against the ever present hazards of corrosion, contamination and blowout.

A successful cementing operation must rely heavily on two factors:

The skill of the human element...When Halliburton cements, you get servicemen well trained in their jobs and backed by unequalled experience.

Proper cementing techniques...When Halliburton cements your wells, the most advanced tools, equipment and materials help provide all possible protection for your investment.

Don't be satisfied with second-best cementing for your wells. Get the very best...get Halliburton!



HALLIBURTON

OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

TEST YOUR ADDITIVE I.Q.

Match each of these Halliburton additives to its description:

(A) **MUD-KIL**

(B) **HOWCOGEL**

(C) **GILSONITE**

(D) **HA-5**

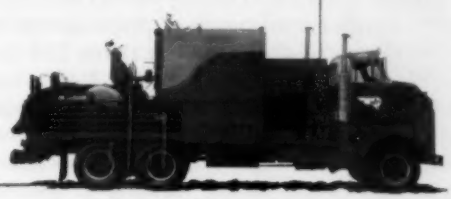
1. A high yield bentonite used in cement to reduce slurry weight and to increase slurry volume. Reduces hydro-static pressure on weak formations, helping prevent lost returns. ☐

2. An improved accelerator for oil well cementing slurries to be used for surface pipe or shallow wells. Higher compressive strengths at early ages are obtained, permitting W. O. C. times as short as four hours on surface pipe at temperatures of approximately 80°F. ☐

3. A dry, granular material that effectively neutralizes the cement-retarding properties of mud treating chemicals such as quebracho and other tannins, starch, sodium carboxymethyl cellulose and lignite. Pumping time and compressive strengths of cement are not appreciably altered. ☐

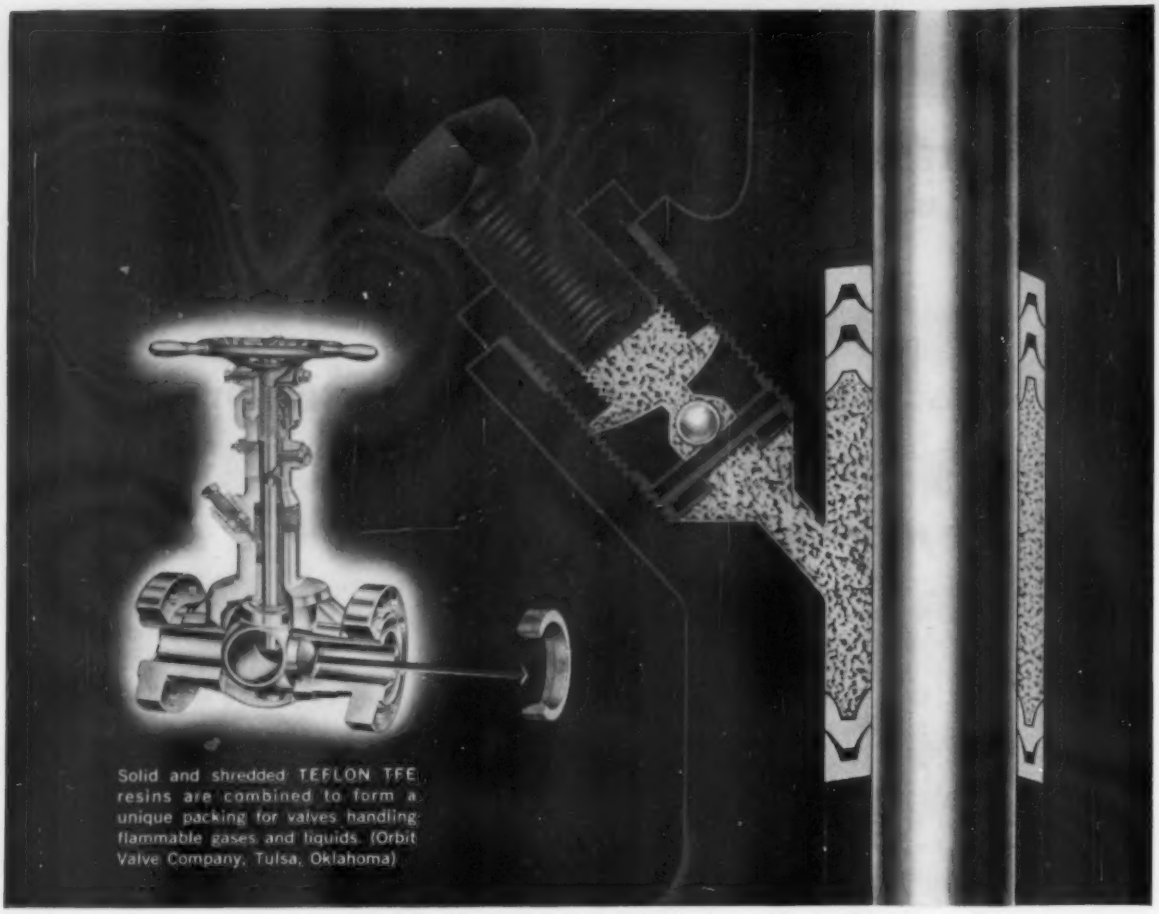
4. A new light weight additive (sp. gr. 1.07) for producing a low density cement with slurry weights down to 10 lbs./gal.; adds volume *NOT* weight. This unusual material is an excellent lost circulation additive. ☐

ANSWERS:
1—(B)
2—(D)
3—(A)
4—(C)



CEMENTING SERVICES

PACE SETTER IN OIL WELL CEMENTING!



Solid and shredded TEFLON TFE resins are combined to form a unique packing for valves handling flammable gases and liquids. (Orbit Valve Company, Tulsa, Oklahoma)

New pressurized packing of TFE resins stops leakage of flammables in gasoline-plant valves

The properties of TFE resins give you exceptional latitude in designing all types of sealing devices. TFE resins can be used up to 500°F. and offer low coefficient of friction. The extreme chemical inertness of TFE resins is unparalleled among packing materials.

This unequaled combination of properties makes possible the packing design pictured above. TFE-fluorocarbon resins are used to make the V-rings and main valve seat. Shredded TFE resins are mixed with other ingredients to form the plastic packing. The use of TFE resins in the rings, seals and packings means reliable, easy-turning valves, resulting in lowered maintenance costs and the reduction of fire and safety hazards. In gasoline plants, valves of this design are handling mixtures of gaseous hydrocarbon feed to fractionators as well as the column reflux liquid. The packing is unharmed by distillates, condensates, paraffin solvents, acids (inhibited) salt water, hot water or sulphur gases.

In your designs, too, there is a place for TFE resins at the hot spots, the friction points, the sealing areas. See your local processor of fluorocarbon resins (listed in the Yellow Pages under "Plastics") or for additional technical data write to: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Rm. T-3029, Du Pont Building, Wilmington 98, Delaware.

In Canada: Du Pont of Canada Limited, P.O. Box 660, Montreal, Que.

DU PONT

REG. U.S. PAT. OFF.

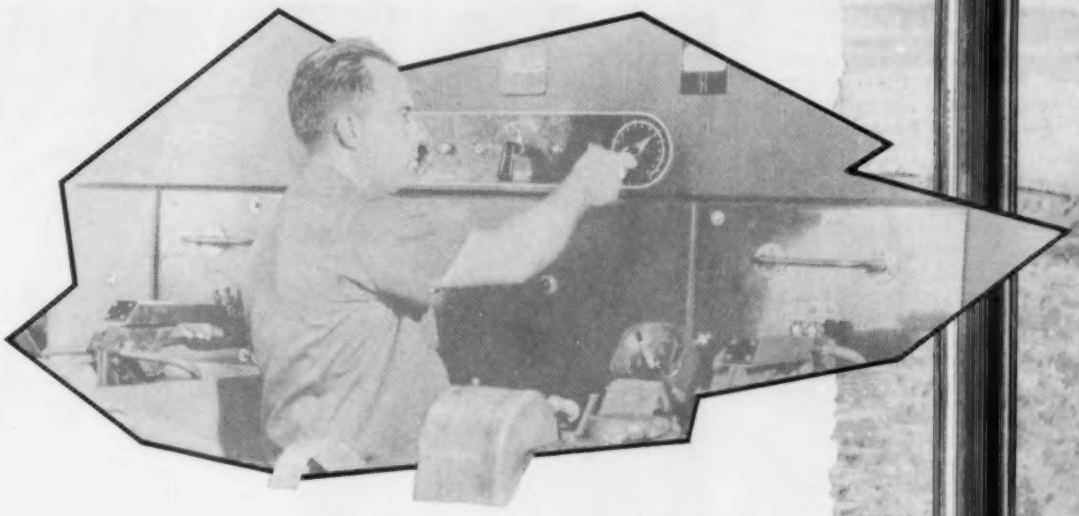
TEFLON®

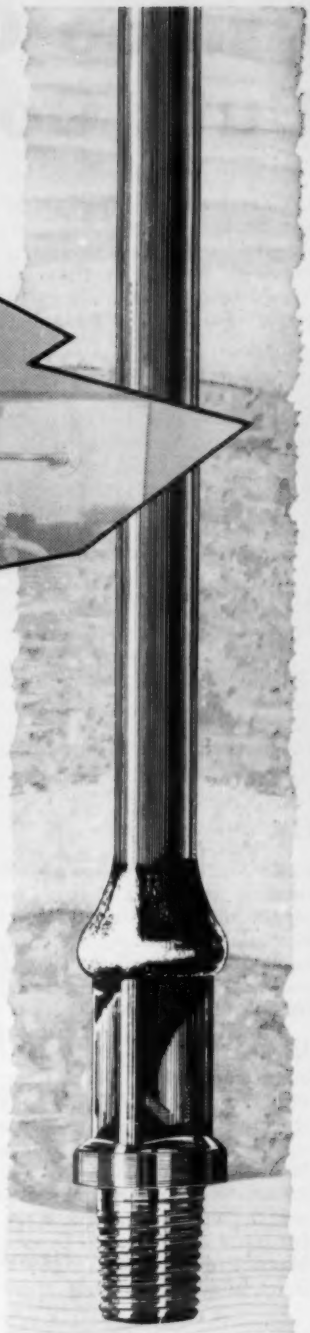
TFE-FLUOROCARBON RESINS

TEFLON is Du Pont's registered trademark for its fluorocarbon resins, including the TFE (tetrafluoroethylene) resins discussed herein.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

From LIBERTY TECHNOLOGY
an excellent NEW product created
to reduce the cost of pumping oil





The LIBERTY
½-Inch Sucker Rod

PUMPING installations for most oil wells should use the time-tested, conventional methods. But for low fluid-volume wells to 5,000 feet in depth, you can save from 10% to 33⅓% with slim hole drilling and completion with the LIBERTY ½-Inch Sucker Rod and LIBERTY Pumping Units.

YOUR NEAREST LIBERTY Field Representative is ready to give technical help in designing installations that can bring YOU these savings. Give him a call, or write LIBERTY. He'll be there when and where you need him.

The LIBERTY ½-Inch Sucker Rod and all LIBERTY products are sold only in Supply Stores, through the LIBERTY SERVICE NETWORK.

LIBERTY
MANUFACTURING COMPANY OF TEXAS
4025 HEMPHILL STREET • FORT WORTH, TEXAS

LM-4

Armco Casing Cuts Costs 3 Ways

Engineers and drilling contractors have found that Armco Slip-Joint Casing gives them definite advantages and economies. Here are three reasons why Armco Casing means lower costs, greater efficiency, and faster running.

FIELD WELDING COSTS LOW

Just stab one end of a 40- or 50-foot joint into the Armco Slip-Joint Collar, make a fast weld, and lower away. The downhand fillet weld required is the fastest and easiest to make. Field welding costs stay down.

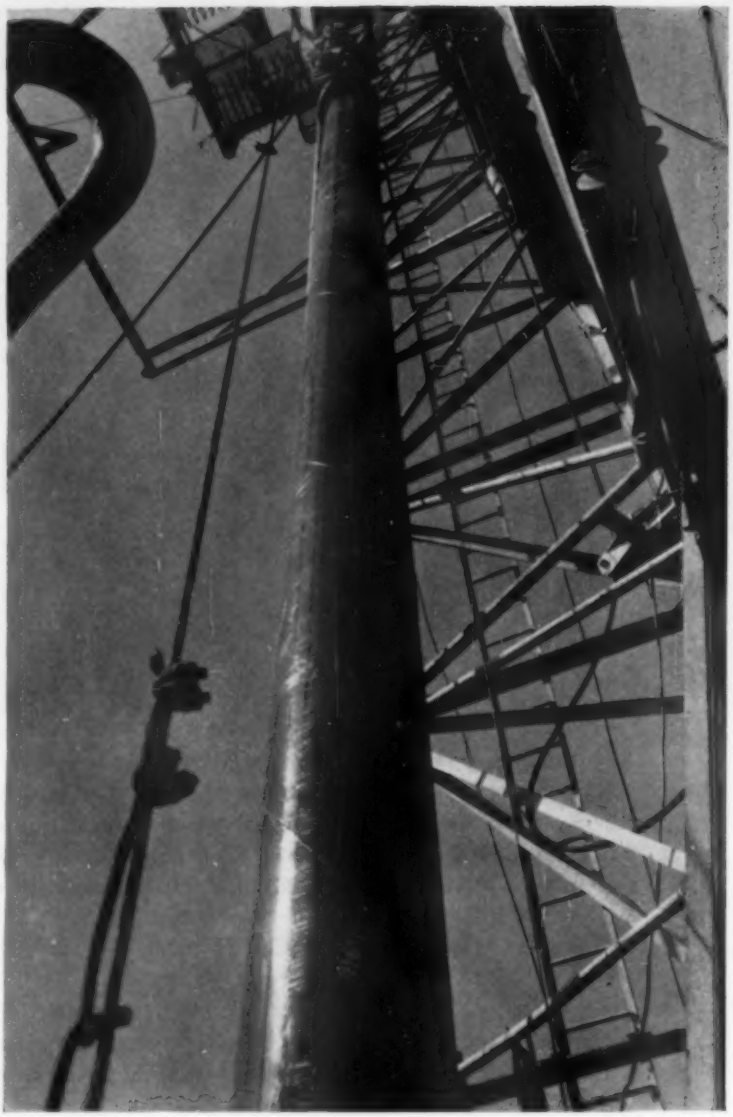
CASING COSTS LOW

The uniformly high collapse resistance of Armco Casing lets operators safely set lighter, lower cost strings to greater depths. Carefully conducted tests show that the variation in collapse pressure for Armco Casing is less than for other types of casing.

LESS RUNNING TIME

Fewer joints in the string mean faster running, lower costs. Armco Casing is supplied in exact 40- or 50-foot lengths instead of the usual random or double-random lengths. Uniform lengths help you quickly determine the footage in the hole or in the stockpile at any time.

Armco Casing is distributed by National Tank Company, Tulsa, Oklahoma, and National Tank Company, Ltd., Edmonton, Alberta, from 21 stocking points throughout the oil country. Sizes range from 6 to 24 inches. When you have a rush job, a call to the nearest stock point listed below will start the casing on the way. Write to us for more data. Armco Drainage & Metal Products, Inc., 5169 Curtis Street, Middletown, Ohio.

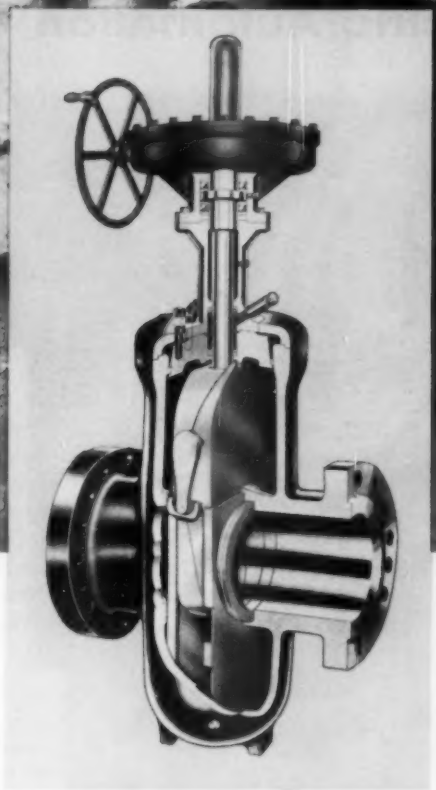


National Tank Company stocking points for Armco Casing: Casper, Wyoming; Clay City, Illinois; El Dorado, Kansas; Farmington, New Mexico; Great Bend, Kansas; Harvey, Louisiana; Hobbs, New Mexico; Houston, Texas; Lake Charles, La.; Liberal, Kansas; New Harmony, Indiana; New Iberia, La.; Odessa, Texas; Oklahoma City, Okla.; Pampa, Texas; Perryton, Texas; Seminole, Okla.; Shreveport, La.; Sidney, Nebraska; Snyder, Texas; Williston, North Dakota.

ARMCO DRAINAGE & METAL PRODUCTS

Subsidiary of ARMCO STEEL CORPORATION

OTHER SUBSIDIARIES AND DIVISIONS: Armco Division • Sheffield Division • The National Supply Company
The Armco International Corporation • Union Wire Rope Corporation • Southwest Steel Products



Leverlock* Gate Valves — A W-K-M Exclusive

W-K-M Pipeline Valves open **free** and close **easy** against any pressure within their rating. An exclusive centralizing mechanism—found only in W-K-M Leverlock Valves—positively holds the gate and segment assembly in a retracted position so that it will move freely between the seats when the valve is being opened or closed.

When the gate and segment reach the fully open or fully closed position—and only then—the centralizing mechanism releases to permit the gate and segment to expand and seat tightly against the upstream and downstream seats.

On Hand

Order 2-inch through 12-inch sizes from your supply store. Larger sizes to 34-inch available on special order from factory. Sizes 6-inch and larger are Leverlock Valves. ASA 300 pounds to ASA 1500 pounds.

*Trademark of ACF Industries, Inc.

The W-K-M® Through-Conduit Gate Valve is your valve

W-K-M's creative engineering designed this valve to solve *your* pipeline valve problems. It has been produced to meet your specifications for strength, long life and economy. Before it reaches you, it will have undergone rigorous and thorough testing.

That's why field men recommend the W-K-M Through-Conduit Gate Valve, why engineers specify its use. Its reputation inspires confidence—its dependability has been proved in service throughout the world.

It's *your* valve; specify and use it.

A Product of W-K-M's *Creative Engineering*

WRITE FOR CATALOG 300

W-K-M

DIVISION OF ACF INDUSTRIES
INCORPORATED
P. O. BOX 2117, HOUSTON, TEXAS
Export Office: 45 ROCKEFELLER PLAZA, NEW YORK, N. Y.

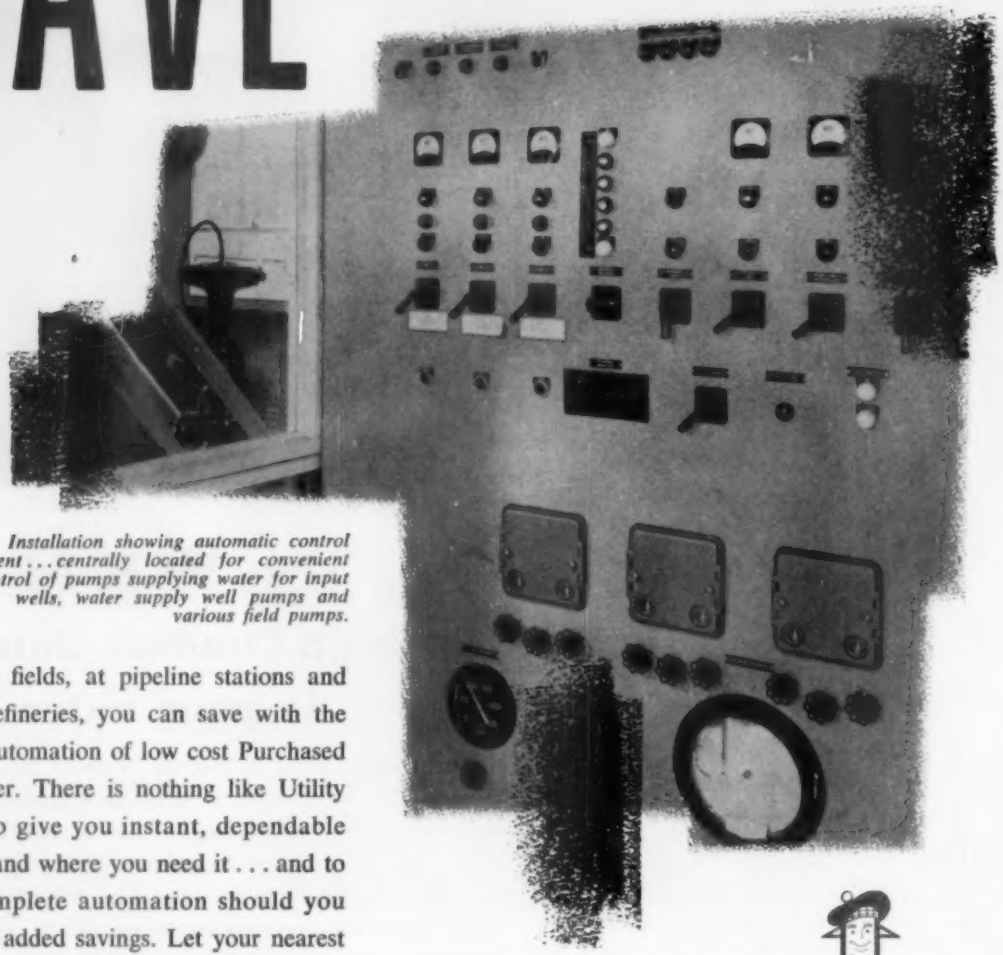
5818

SAVE money

SAVE manpower

SAVE maintenance

SAVE with Electric Automation



Installation showing automatic control equipment . . . centrally located for convenient control of pumps supplying water for input wells, water supply well pumps and various field pumps.

In producing fields, at pipeline stations and throughout refineries, you can save with the dependable automation of low cost Purchased Electric Power. There is nothing like Utility Electricity to give you instant, dependable power when and where you need it . . . and to give you complete automation should you require it for added savings. Let your nearest Utility Electric Power Company show you how you can save more with Purchased Electric Power . . . or write us.

Purchased Electric Power . . .
saves money, manpower, maintenance and serves you better automatically

Petroleum Electric Power Association

P.O. BOX 35006, DALLAS 35, TEXAS

WICHITA CLUTCHES

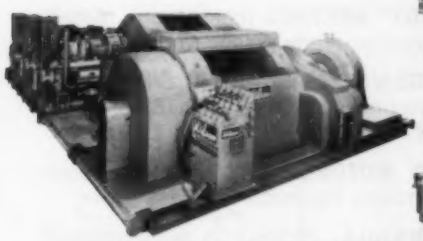
– SO GOOD OVER 4,000 USED ON WILSON DRILLING RIGS and WINCHES!

Drilling rigs and winches receive just about the most abuse of any type of major machinery which is one reason why the clutches have to be the best. For the past 10 years Wilson has standarized on Wichita Clutches. While operating in every type of weather, in all parts of the world, and under the most severe conditions, Wichita Clutches have performed perfectly. A Wichita Air-Tube Disc Clutch has proved to be one of the major components on Wilson drilling Rigs with as many as 14 being used on each rig.

This simple, compact, powerful, trouble-free, Air-Tube Friction Clutch makes possible convenient remote control operations, smoother and faster starting and stopping. It also means longer service at a lower cost because it requires very little maintenance.

You Name it . . . Wherever a Clutch is needed . . . There's a Wichita Clutch to meet the need.

Below is a view of one of the huge Wilson Drilling Rigs.



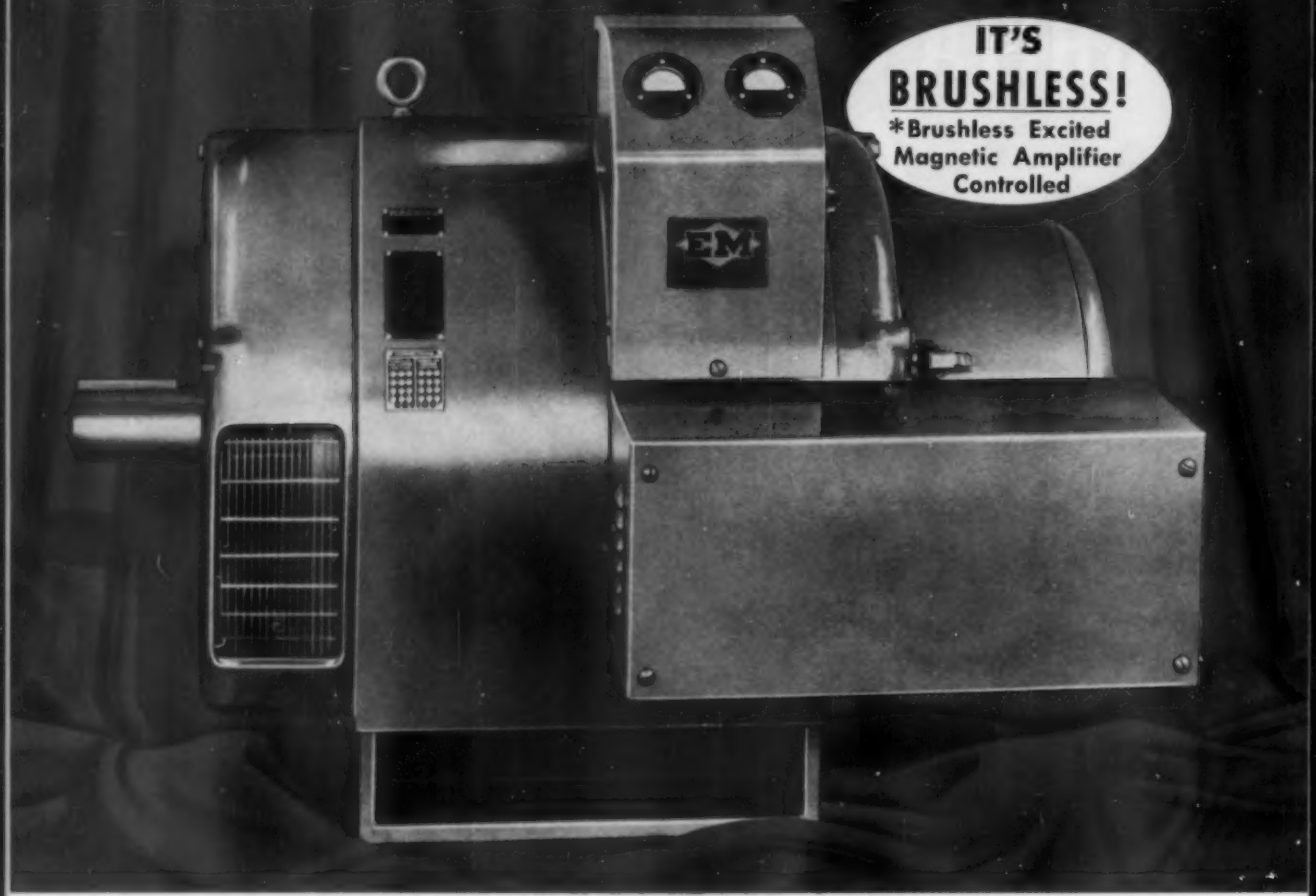
At right, is a floor plan of a Wilson rig showing the use of fourteen Wichita Clutches.

WICHITA Clutch COMPANY, INC.
WICHITA FALLS, TEXAS, U.S.A.

Contact your nearest Wichita Engineer!

Brehm-Lahner, Inc., Detroit, Michigan
L. H. Fremont, Cincinnati, Ohio
W. G. Kerr Company, Pittsburgh, Pa.
Smith-Keser & Co., Avon, Conn., Philadelphia 44, Pa., and New York, N. Y.
Frank W. Yarline Co., Chicago, Illinois
Larry W. McDowell, Long Beach, California
Andrew T. Lobel, Denver, Colorado
Robert R. King Co., Cleveland, Ohio
Norman Williams, Houston, Texas
Allied Transmission Equipment Co., Kansas City 8, Missouri
Donald E. Harman, Dallas, Texas
C. Arthur Weaver, Richmond, Virginia
Malcolm S. Cone, Memphis, Tennessee
Dominion Power Press Equipment, Ltd., Burlington, Ontario, Canada
R. E. Kunz, Seattle 4, Wash.
W. G. Ballantyne Co., Portland 4, Ore.
Bates Sales Co., St. Louis 1, Mo.

NOW for men who hate maintenance....
the NEW E-M BEMAC* Packaged Generator



RUGGED, RIGHT and READY with 10 BIG ADVANTAGES for you

1. **LICKS THE MAINTENANCE PROBLEM.** BEMAC has no commutator, no slip rings, no brushes! Requires no servicing other than an occasional bearing check.
2. **SAFER IN HAZARDOUS ATMOSPHERES.** No sparking contacts in the regulator or excitation system. Eliminates need for special enclosure on many applications.
3. **SIMPLE TO OPERATE.** No complicated servicing or adjustments — anyone can operate BEMAC.
4. **MAGNETIC AMPLIFIER "MAGIC"** automatically regulates voltage — a unique static voltage sensing circuit keeps the voltage "on the beam."
5. **POSITIVE VOLTAGE CONTROL** — easily set to help compensate for line voltage drop.
6. **"ROCK-STEADY" VOLTAGE** makes your motors, lights, and electronic equipment work better.
7. **BROAD-RANGE VOLTAGE** makes it simple to get the voltage you need . . . 120/208-139/240 and 240/416-277/480 volts.
8. **STARTS BIG MOTORS.** Built-in voltage boost transformer makes big motor starting easier.
9. **EASY TO INSTALL.** BEMAC is self-contained, completely factory assembled.
10. **BACKED BY 60 YEARS' EXPERIENCE** by the country's largest manufacturer of "Packaged" Generators . . . your best assurance of top quality performance and long life from every heavy-duty BEMAC "Packaged" Generator.

E-M

2110-TPA-2210

ELECTRIC MACHINERY

The finest in "Packaged" Generators

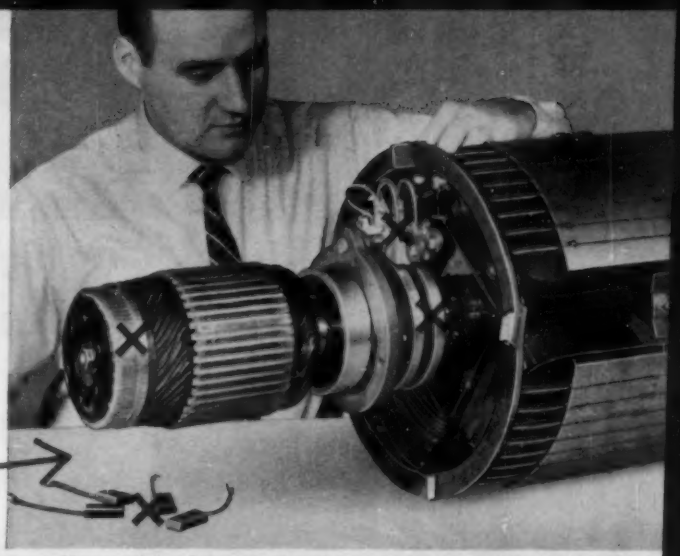
NO COMMUTATOR
NO SLIP RINGS, NO BRUSHES

BEMAC is better suited for corrosive, dusty, and hazardous atmospheres

Conventional generators receive D-C excitation from exciters thru commutator, slip rings, and brushes. In BEMAC these parts are replaced by static silicon rectifiers.

LOOK WHAT HAPPENED TO MAINTENANCE...

WHEN WE SUBSTITUTED AGELESS SILICON RECTIFIERS



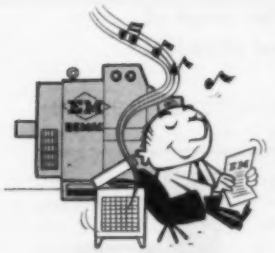
Many points of wear and maintenance now can be eliminated.

A.C. to D.C. rectification is made with reliable, efficient silicon diodes.

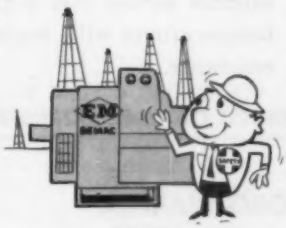
There are no moving electrical contacts — sparking is eliminated. There are no electrical parts subject to wear and damage from dust and dirt — you have highest operating reliability.

Your E-M Field Engineer will be glad to give you more information on E-M BEMAC "Packaged" Generators equipped with automatic static voltage regulators. BEMAC is available in ratings of 10 thru 150 kw, 3 phase; 10 thru 100 kw, 1 phase; 1200 and 1800 rpm; 0.8 PF; 60 cycle; 120/208-139/240 and 240/416-277/480 volts, 3 phase; 120/240 volts, 1 phase.

● **New Literature:** Write factory for your copy of publication No. 255. It tells how BEMAC works.

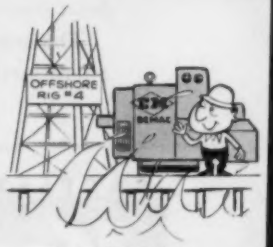


LESS RADIO INTERFERENCE



SAFER IN HAZARDOUS ATMOSPHERES

MORE DUST RESISTANT



LESS AFFECTED BY CORROSION

MFG. COMPANY MINNEAPOLIS 13, MINNESOTA

from the Originators of "Packaged" Generators

REMARKABLE *new* RIGID PLASTIC PIPE!

★ Higher Tensile Strength
★ Higher Heat Resistance

MADE OF CYCOLAC® C ABS

ABS TYPE II
Thermoplastic Resin
(NSF APPROVED)

New Thermoplastic Resin from BORG-WARNER

Now there are two types of ABS rigid plastic pipe made of Cycolac, the *tough* thermoplastic. The original Borg-Warner Cycolac L ABS Type I resin has already proved its worth in scores of applications from coast to coast.

The new Cycolac C ABS Type II resin offers increased tensile strength, greater heat resistance and other important advantages over metal. Among these are light weight, ease of installation and protection against corrosion.

To users of pipe, Cyclolac C offers superior service over a greater range of temperatures with increased chemical resistance.

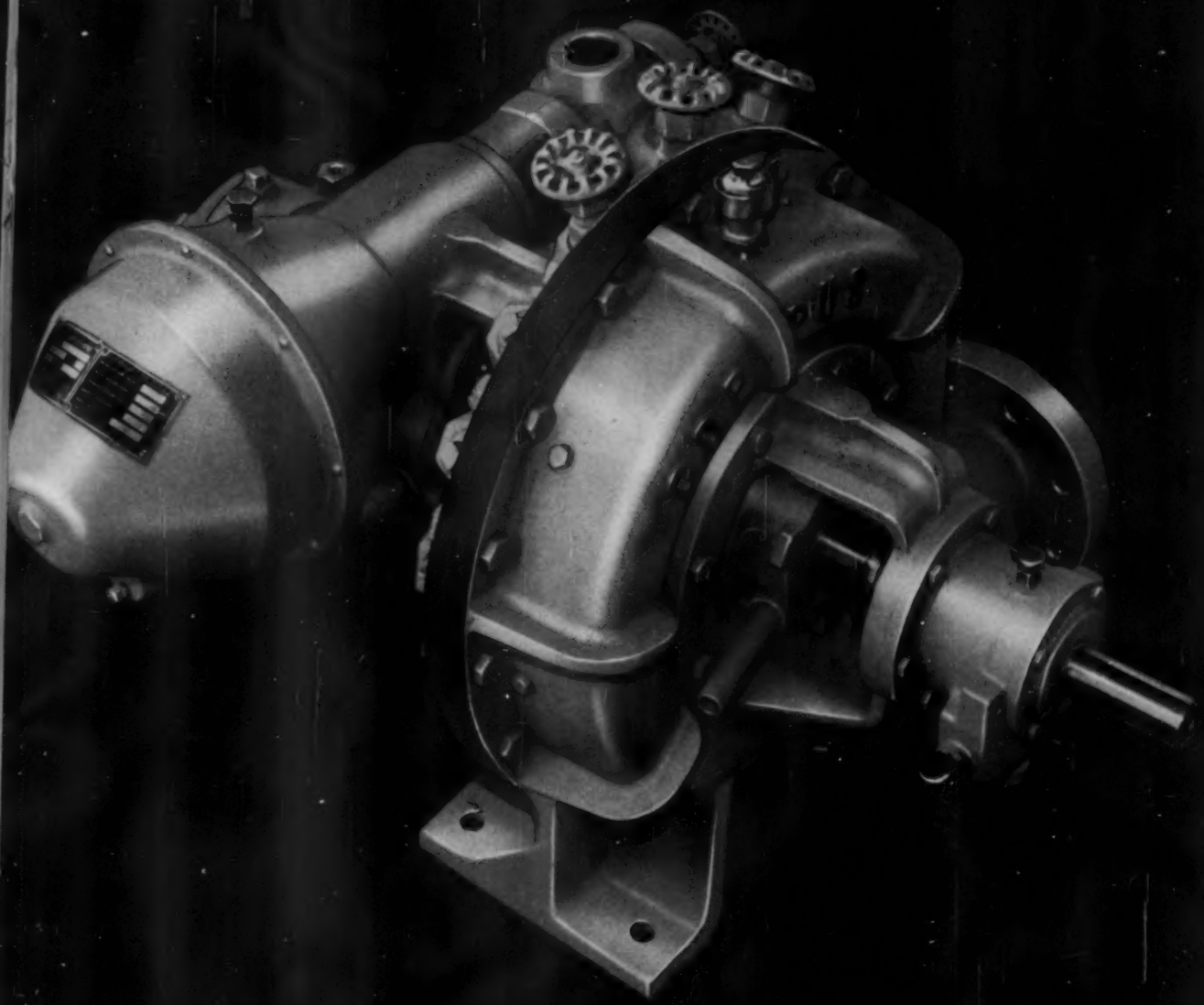
WRITE FOR NAME OF YOUR NEAREST CYCOLAC EXTRUDER

PACESETTER IN
Marbon CHEMICAL
SYNTHETIC RESINS

DIVISION of BORG-WARNER
WASHINGTON, W. VA. • GARY, INDIANA
also represented by:
WEST COAST: Harwick Standard Chemical Co., Los Angeles, Cal.
CANADA: Dillons Chemical Co. Ltd., Montreal & Toronto
EXPORT: British Anchor Chemical Corp., New York

BW® Marbon

COPPUS BLUE RIBBON PRODUCTS



Coppus Horizontal Steam Turbine

NEW RUGGED DESIGN—BLUE RIBBON RELIABILITY! Here's a new dimension in turbine performance! Coppus brings you a new rugged stability of design . . . a new measure of reliability in a complete range of power-packed turbines, from 1 HP to 250 HP — marked with the Blue Ribbon only after each is precision made . . . precision tested. Performance features like these assure you Blue Ribbon Reliability —

A totally enclosed governor . . . totally enclosed, independently operated safety trip . . . easily replaceable packing and bearings . . . multiple steam nozzle control . . . brake rim for added safety . . . wide bucket "L" type wheel (optional) for minimum water rate.

Coppus Turbines are built to customers' specifications, including API and NEMA standards. All Coppus Products carry the same Blue Ribbon assurance of reliable performance. For further facts on turbines, send for new Catalog 200. COPPUS ENGINEERING CORPORATION, 262 Park Avenue, Worcester, Mass. Sales Offices in *Thomas' Register*.

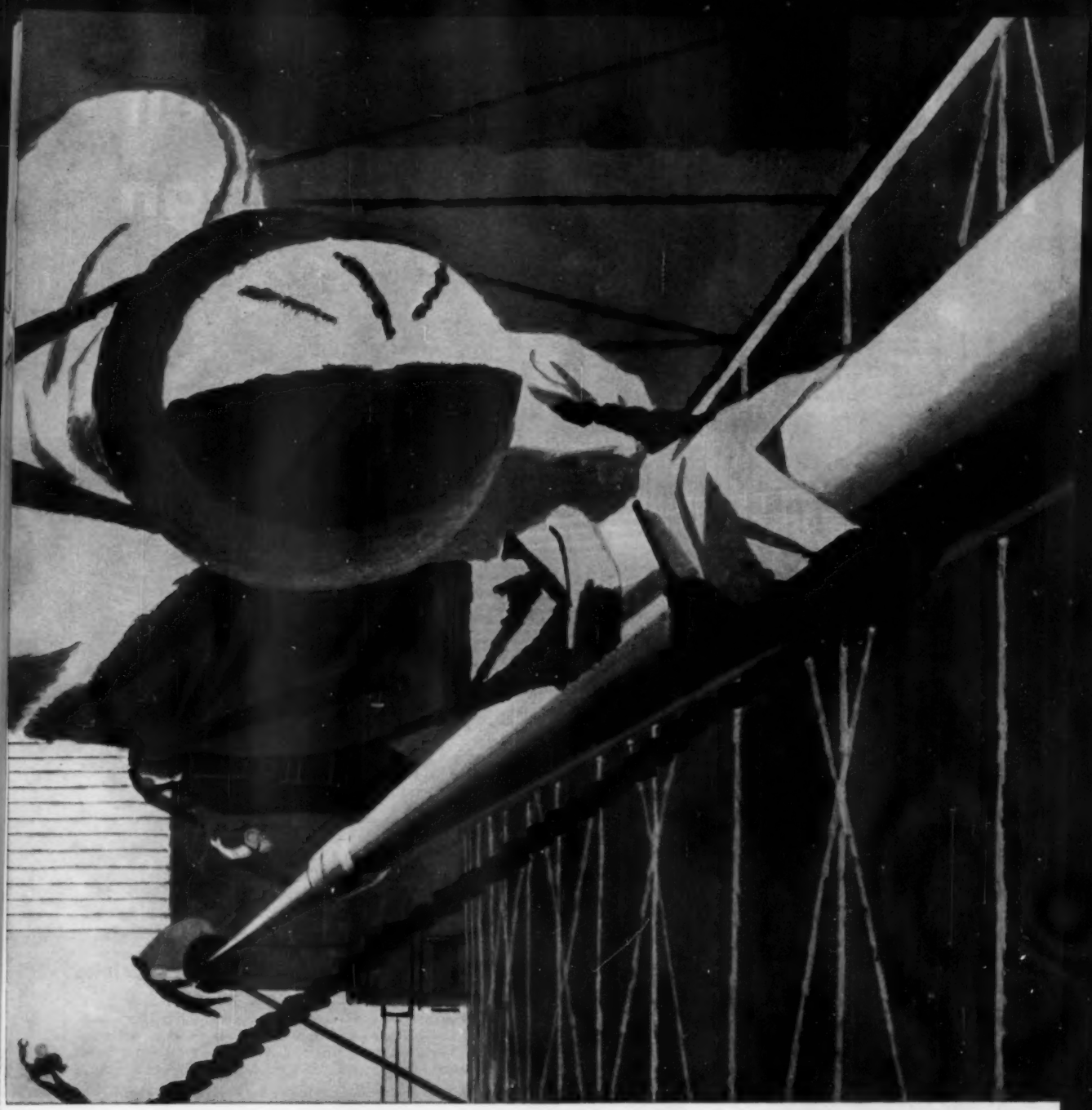
COPPUS
STEAM TURBINES

Up on the monkey-board

IT'S nerve-tingling work standing on a monkey-board, 100 feet up on a derrick, grappling with a 90-foot length of 4½-inch drill pipe. A job like this calls for a qualified derrickman!

Doesn't the same hold true with tubular materials? Doesn't the job of searching far beneath the earth's surface call for *qualified* materials that can stand up under severe twisting action, fatigue and collapse—materials that are designed to drill deep today . . . deeper tomorrow?

That's why USS National Seamless Oil Country Tubular Products are acknowledged the world over as the most ideal materials for deep-well work. They *have* the strength and dependability to do any oil country job. Their outstanding strength can be attributed to not one, but two vital factors—quality steel and a quality control method of manufacture. Each seamless tube is pierced from a solid billet



of steel. And only steel of the very best forging properties and of the highest uniformity can be used, since the modern piercing operation tends to seek out any defects in the metal.

For drill pipe, casing and tubing that can really *take it*—products that will consistently give you the most service *per dollar invested*—remember to specify USS National Seamless Oil Country Tubular Products . . . every time.

For further information, write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa. Export distributors: United States Steel Export Company, New York. *(USS and National are registered trademarks*

National Tube Division of USS **United States Steel**

New high capacity V-belt revolutionizes drive design

Makes drives far more compact... cuts cost as much as 20%

Here is a major advance in the field of power transmission — the fully proved Gates Super HC V-Belt, developed in the world's largest belt-testing laboratories at The Gates Rubber Company.

The Gates Super HC V-Belt makes possible the lowest-cost, lightest-weight, most compact multiple V-belt drive that can be put on any machine! Sheave diameters can be reduced up to 50%, sheave widths 30% to 50%, center distances 20% and more.

On new drives, the cost of a Gates Super HC V-Belt Drive is as much as 20% less than present V-belt drives of the same horsepower capacity.

Learn more about the cost-saving Super HC Drive

For detailed information on the Super HC Drive, contact your nearby Gates distributor or Gates Office for new booklet, *"The Modern Way to Design Multiple V-Belt Drives."*

For utmost space, weight and dollar savings in new drives or drive replacements, specify Gates Super HC V-Belts and Sheaves. Stocks immediately available in principal industrial centers.

How savings multiply with Gates Super HC V-Belt Drive

Cost of a new Gates Super HC V-Belt Drive is as much as 20% less than cost of a drive of comparable horsepower using present V-belts. In addition to the lower cost of the drive itself, further economies are realized on housings and bases — economies in materials, production time, shipping costs.

Shown below are space savings of a typical installation...

	DriveR Sheave Diam.	DriveN Sheave Diam.	Center Distance	No. of belts
Present Drive	7.4"	20.0"	42.9"	4
Super HC Drive	5.3"	14.0"	30.0"	3

The Gates Rubber Company, Denver, Colorado • Gates Rubber of Canada Ltd., Brantford, Ontario

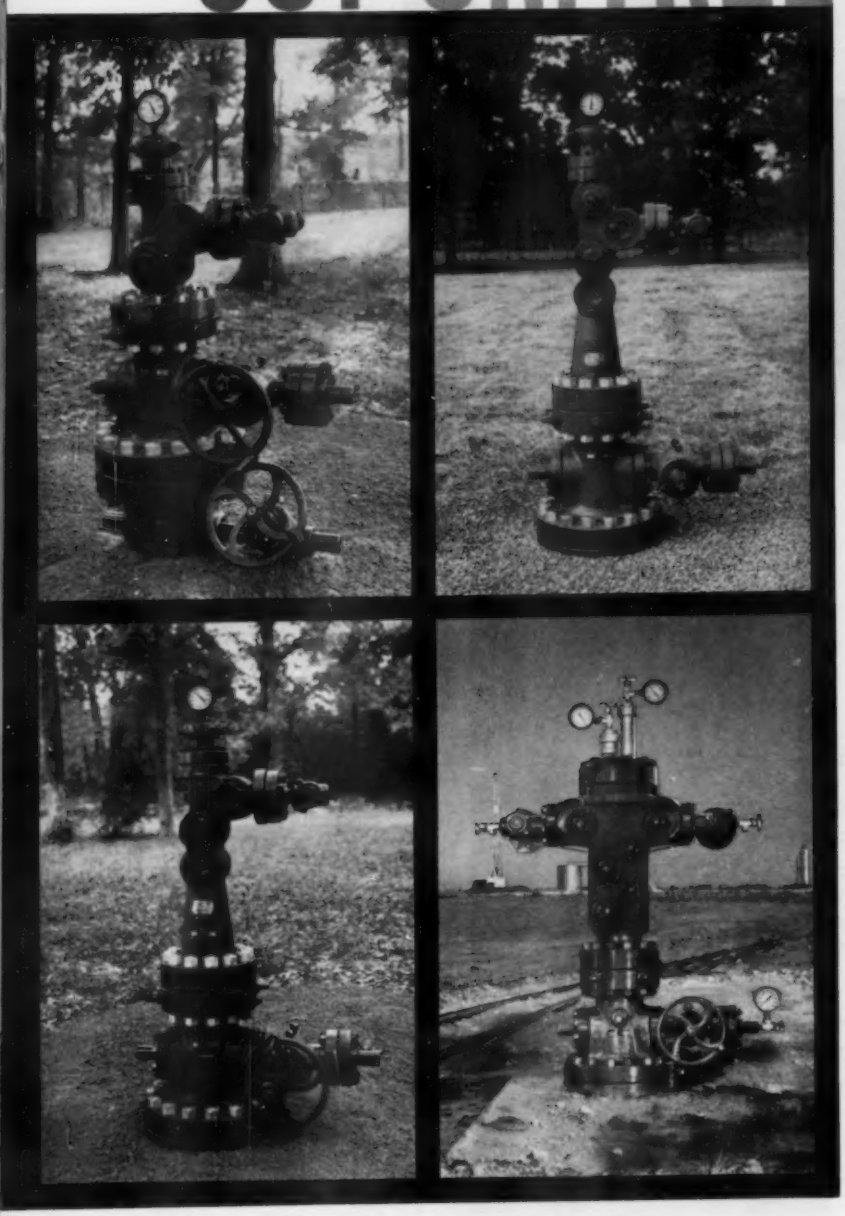
Gates

World's Largest Maker of V-Belts

Gates Super HC V-Belt Drives

OCT UNITREE

PIONEERED, DEVELOPED AND PERFECTED BY OCT



FIRST MAJOR ADVANCEMENT IN WELLHEAD EQUIPMENT SINCE SPINDLETOP

The Unitree is Oil Center Tool Company's answer to the need for compactness, flexibility and economy in wellhead equipment.

Weight and height saving are approximately 40 per cent of conventional equipment with equal pressure rating. There are no joints to leak nor bolts to stretch. Ring joints are eliminated. No flange protectors or ring guards are needed.

The valves are complete plug-in components and are replaceable in the field. No platforms or scaffolding are required for installation, nor for operation of valves. Low overall height facilitates use with low or floating substructure.

Unitrees are available in working pressures from 3,000 to 15,000 pounds.

There is a Unitree to meet your production problem. Contact your O-C-T representative.

For additional details on the Unitree, contact an O-C-T representative, or write to Oil Center Tool Co., P. O. Box 3091, Houston, Texas.

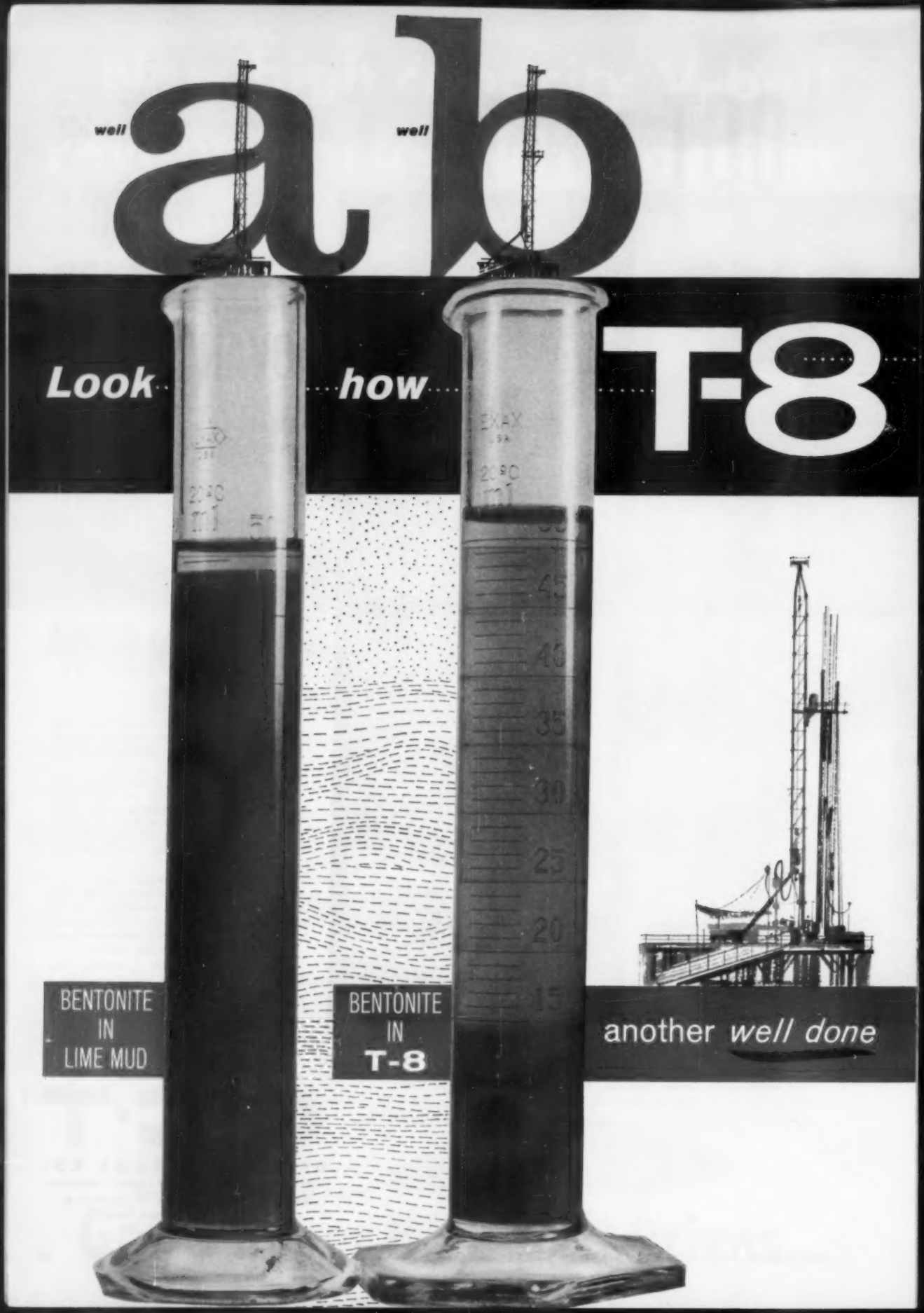
where progress is a daily practice

O·C·T

OIL CENTER TOOL CO.

SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

Address Export Inquiries for All Countries to P. O. Box 3091, Houston, Texas.


well
well
a,b
Look
how
T-8
BENTONITE IN LIME MUD
BENTONITE IN T-8
another well done

.....and Magcobar engineering cut mud cost on well b

NEW ORLEANS AREA

	depth	type mud	weight mud	cost of mud
a	13,600 ft.	Lime	15.6 lb./gal.	$130,000
b	13,590 ft.	T-8	15.6 lb./gal.	$ 65,000

All along the Gulf Coast, savings have been substantial using T-8 instead of other muds in drilling shale formations. The secret of T-8, as the graduates to the left show, is that it reduces the hydration and dispersion of solids, minimizing the build-up of formation solids in the mud system.

With other muds, shale solids become part of the drilling fluid, increasing the viscosity. Water, added to reduce viscosity, lowers the mud weight, and new barite must be added. The additional barite and water increase the volume, so that expensive mud is jetted. With T-8 you can maintain good mud properties with less jetting, less barite, and at impressive savings.

The successful field performance of T-8 confirms Magcobar's basic approach to drilling fluid problems: Developing better products to solve specific drilling problems, and training better mud engineers to insure the highest level of performance from these products.

T-8 is only one of Magcobar's many answers to the problem of high drilling costs. The right products *used right* by Magcobar can cut costs on your next well, too.

Wherever your drilling operations, you can use Magcobar engineering and products. There are more than 500 stockpoints in the U.S. and Canada. Elsewhere, write Foreign Operations, P. O. Box 6504, Houston, Texas.

with Magcobar Technology

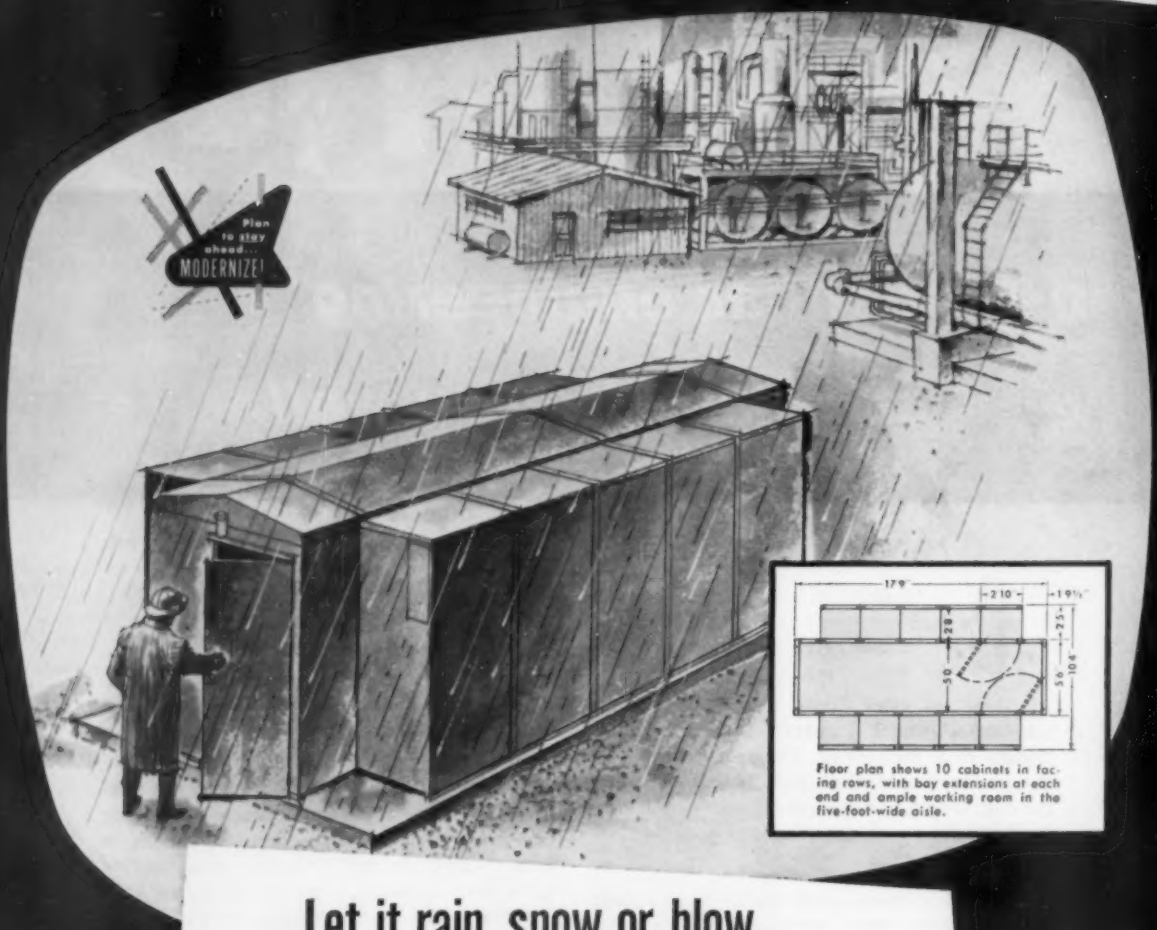
MAGNET COVE BARIUM CORPORATION

Houston

Magcobar
Complete
DRILLING MUD SERVICE

full SCOPE of
MOTOR CONTROL from...

ALLIS-CHALMERS



Floor plan shows 10 cabinets in facing rows, with bay extensions at each end and ample working room in the five-foot-wide aisle.

Let it rain, snow or blow...

New, *Shelter-Clad* walk-in enclosures provide complete protection for personnel and motor control

With the new Allis-Chalmers all-steel, walk-in enclosure, you can eliminate expensive, permanent buildings. Your field personnel can carry on inspection and maintenance work in complete safety and convenience, regardless of the weather. *Shelter-Clad* units can even be arranged to provide space for your field office work.

Simple, Flexible Packaged Units

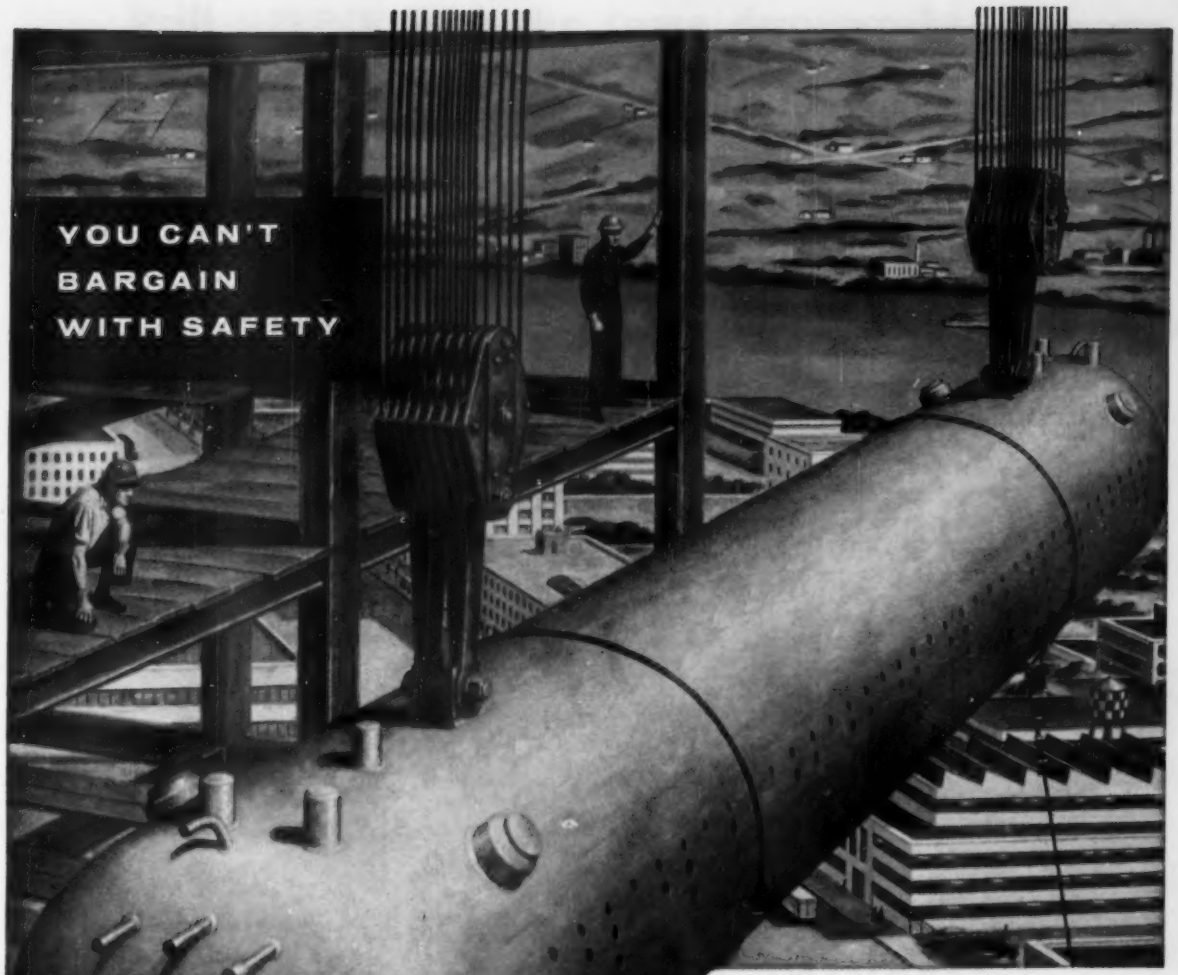
Two facing rows of Allis-Chalmers Type H, 2000 to 5000-volt motor controllers are bridged by a sturdy metal roof with the backs of the control cabinets forming the outside walls. A five-foot-wide aisle, extending the length of the unit, is enclosed with doors at each end. A basic unit can consist of any number of facing cabinets — and any number of pairs of cabinets can easily be added or removed. These units meet NEMA 3 and 4 standards for weather resistance.

For details, contact the A-C office near you, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

Shelter-Clad is an Allis-Chalmers trademark.

A-C ALLIS-CHALMERS

A-5881



This 240,000-pound steam drum, built by Combustion Engineering for a large generating plant, is here being hoisted 120 feet into position by strong wire rope. It's a striking example of how . . .

safety rides on quality wire rope

You may never hoist loads as large as this 120-ton drum. But *safe, top quality wire rope is just as important to your own operations.* For, although the price of a "bargain" rope would be less, failure of such a rope could cost you thousands of dollars in wrecked equipment. Don't be a victim of false economy. Buy a wire rope that's a quality rope—buy Wickwire Rope.

5339

WICKWIRE ROPE — A CF&I PRODUCT

CF&I

LOOK FOR THE YELLOW *TRIANGLE*

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

THE COLORADO FUEL AND IRON CORPORATION—Albuquerque • Amarillo • Billings • Boise • Butte • Casper • Denver • El Paso Farmington (N. M.) • Fort Worth • Houston • Kansas City • Lincoln (Neb.) • Odessa (Tex.) • Oklahoma City • Phoenix • Pueblo Salt Lake City • Tulsa • Wichita • **PACIFIC COAST DIVISION**—Los Angeles • Oakland • Portland • San Francisco • San Leandro Seattle • Spokane • **WICKWIRE SPENCER STEEL DIVISION**—Boston • Buffalo • Chattanooga • Chicago • Detroit • Emlenton (Pa.) New Orleans • New York • Philadelphia

STRONG as steel pipe

. . . at one-eighth the weight!

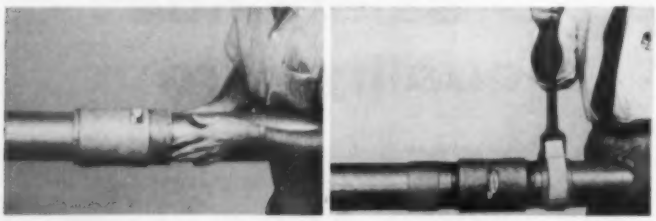
Circumferential Tensile Strength . . . 80,000 psi

BONDSTRAND®

the revolutionary fiber glass reinforced epoxy pipe for corrosive service

Here's a pipe that holds up indefinitely under the corrosive action of many salt, acid and alkaline solutions . . . that can't contaminate or flavor the piped material . . . that is rigid enough to resist sag, cold flow or deformation – flexible enough to follow normal ditch contours . . . that remains smooth and unclogged throughout its entire service life . . . that won't leak, even near its burst pressure.

Easy to install, with choice of locking wedge or threaded fittings.



Simple instructions with each shipment insure a perfect joint on the first try.

IN THE PETROLEUM INDUSTRY...

Consider BONDSTRAND for gathering, salt water disposal, offshore pumping and tanker loading lines; and for cooling towers, tank vents and gaging tubes. It won't corrode inside or out . . . won't pick up paraffin or gypsum . . . and is unaffected by petroleum products, hydrogen sulfide, fresh and salt water, and problem soil conditions.

Amercoat® CORPORATION

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A Subsidiary of American Pipe & Construction Company

Drill DEEPER with the same drawworks . . .

with AMERICAN IRON *Straight Grip* "OPEN-HOLE" TOOL JOINTS!

ONE-THIRD LIGHTER
than any other brand tool joint!

AMERICAN IRON OPEN-HOLE Straight-Grip tool joints on light weight drill pipe average 6% lighter weight than any other tool joint and drill pipe combination! This means your rig, drilling with 6,500 feet of drill pipe, could increase the length of string to 8,400 feet by changing to light weight drill pipe with OPEN-HOLE Straight Grip tool joints.

This light weight Straight Grip tool joint has the same famous features as our regular Straight Grip. Precision machining and accurate gauging guarantee the famous 4-point seal protection against joint leakage and creep.

Increase your drilling profits by going deeper with the same drawworks. Next time, specify AMERICAN IRON Straight Grip OPEN-HOLE tool joints on your light weight drill pipe!

AMERICAN IRON OPEN-HOLE TOOL JOINTS
First and only tool joints designed specifically for use on light weight drill pipe and tubing.
AVAILABLE IN STRAIGHT GRIP, FLASH WELDED AND BUCKED-ON TYPES.

Available through your Supply Store

Another AMF Product PETROLEUM EQUIPMENT

AMERICAN IRON & MACHINE WORKS COMPANY, INC.
518 North Indiana Avenue • Oklahoma City, Oklahoma
Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

36 Years' Experience in Designing and Manufacturing Oil Field Equipment.

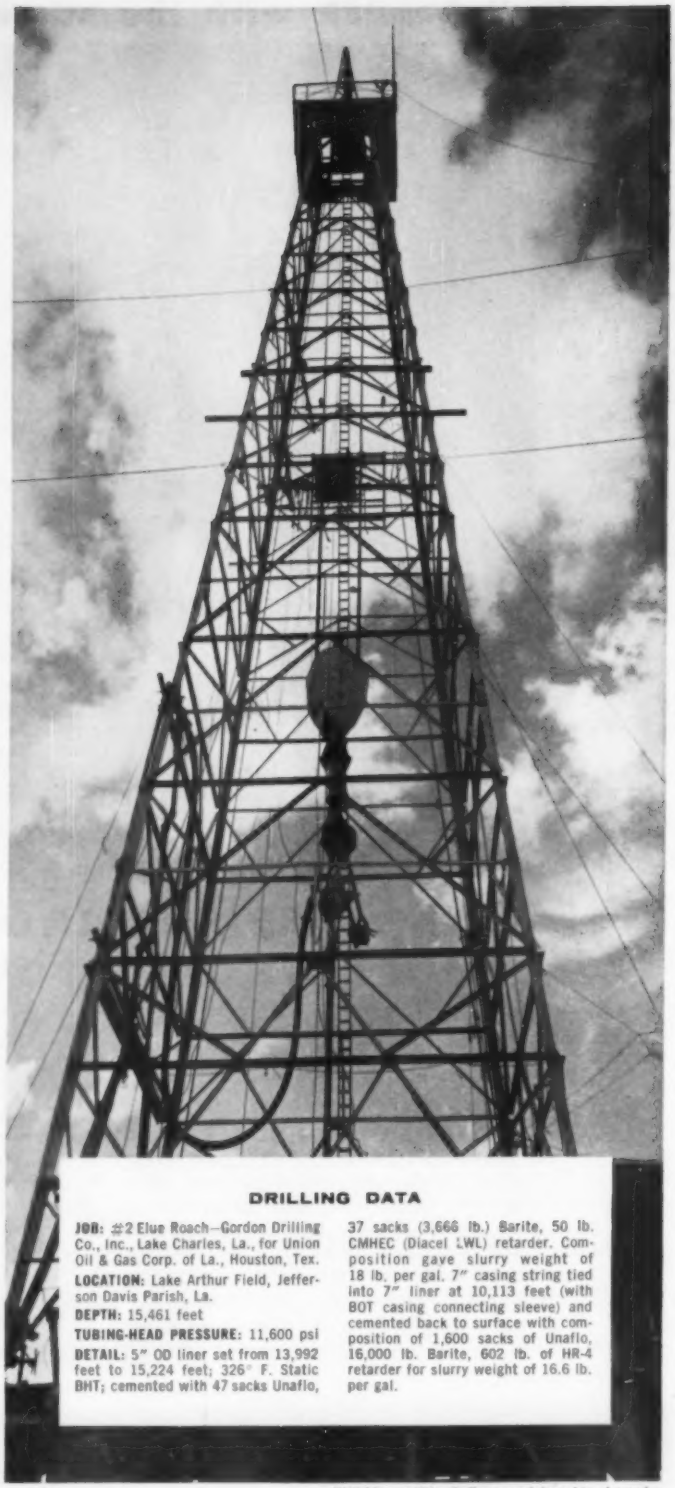
AMERICAN IRON & MACHINE WORKS CO. INC. • OKLAHOMA CITY •

At 360° F. Static BHT— slurries stay fluid with **Unaflo** Oil-Well Cement

On deep, high-pressure jobs, where an API Class F cement is needed, oilmen have learned to rely on Unaflo retarded oil-well cement. Fully compatible with other retarders, Unaflo cement helps make slurries pump easily, so that they follow the irregularities of well bore and pipe. Slurries stay fluid and pumpable under severe conditions of temperature and pressure, forming a strong, watertight, sulphate-resistant seal when set. Unaflo cement gives the dependable seal produced by a heavier and stronger slurry, plus the easy pumpability of a light, thin slurry. And its retarded set sustains high initial fluidity. It allows proper placement of cement, as well as an added margin of safety for delays or emergencies.

At varied depths and pressures, for cementing or recementing, for plug-backs or squeezes, Unaflo cement provides the **workable** slurry—one that pumps easily, sets hard. For more information, write Universal Atlas, 100 Park Avenue, New York 17, N. Y.

OFFICES: Albany • Birmingham • Boston • Chicago Dayton • Kansas City • Milwaukee • Minneapolis New York • Philadelphia • Pittsburgh • St. Louis • Waco



DRILLING DATA

JOB: #2 Elue Roach—Gordon Drilling Co., Inc., Lake Charles, La., for Union Oil & Gas Corp. of La., Houston, Tex.

LOCATION: Lake Arthur Field, Jefferson Davis Parish, La.

DEPTH: 15,461 feet

TUBING-HEAD PRESSURE: 11,600 psi

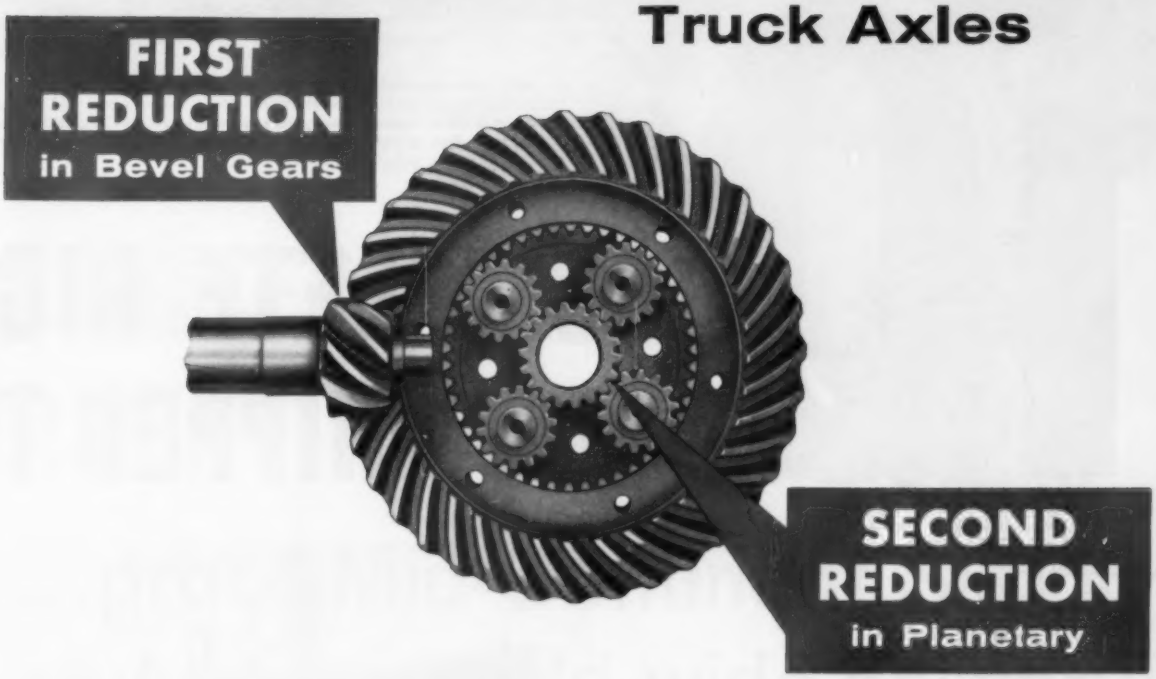
DETAIL: 5" OD liner set from 13,992 feet to 15,224 feet; 326° F. Static BHT; cemented with 47 sacks Unaflo, 37 sacks (3,666 lb.) Barite, 50 lb. CMHEC (Diacel LWL) retarder. Composition gave slurry weight of 18 lb. per gal. 7" casing string tied into 7" liner at 10,113 feet (with BOT casing connecting sleeve) and cemented back to surface with composition of 1,600 sacks of Unaflo, 16,000 lb. Barite, 602 lb. of HR-4 retarder for slurry weight of 16.6 lb. per gal.

U-157

"USS" and "Unaflo" are registered trademarks

Universal Atlas Cement
Division of
United States Steel

A New Concept in Double Reduction Truck Axles



Eaton Planetary Double Reduction

Gives You these Important Benefits!

Save Weight—Size for size, Eaton PDR Axles weigh less than conventional herringbone or spur gear axles, permit truckers to haul more legal payload.

Last Longer—In Eaton PDR Axles, gear tooth loads are equally distributed over four rugged "planet" gears; stress and wear are reduced, resulting in materially longer axle life. Eaton's forced-flow lubricating system provides positive lubrication to all moving parts, even at slowest vehicle speeds—a feature not available in other double reduction axles.

Cost Less to Maintain—When and if repairs are necessary, parts are readily available—most of them interchangeable with other Eaton Axles. Simple construction—similar to the famous Eaton 2-Speed Axle, with which all truck service men are familiar—holds maintenance labor to a minimum.

Previously, double-reduction axles have been available only in the extra heavy-duty sizes. Eaton PDR Axles are available in a wide range of sizes—the last word in equipment to meet the demands of today's hauling conditions. By actual comparison they cost less to buy, less to maintain. They have established outstanding performance records in all types of heavy-duty operation.

EATON

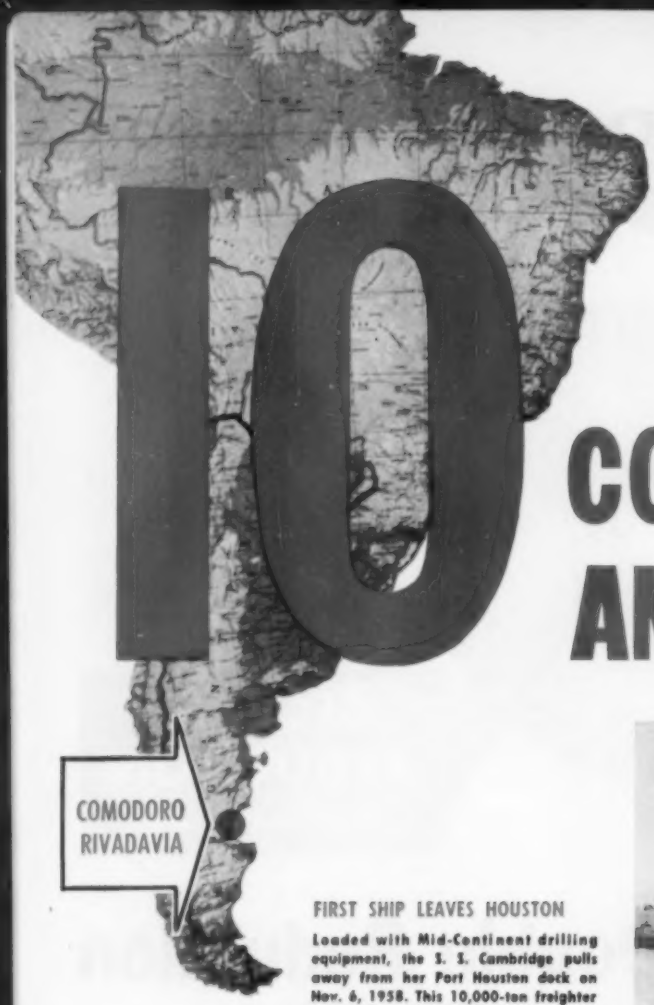
Ask your Truck Dealer for Complete Information about Eaton PDR Axles

EATON

AXLE DIVISION
MANUFACTURING COMPANY
CLEVELAND, OHIO

Each trailer-mounted rig, capable of drilling 9,500 feet, is equipped with Mid-Continent's U-36-A drawworks, rig drives, rotary tables and blocks, Cummins diesel engines, Emsco pumps and a 126-foot Lee C. Moore telescoping mast. Rigs, specially-designed for Argentine drilling, are fully-portable.

10 COMPLETE RIGS AND SHIPPED TO



FIRST SHIP LEAVES HOUSTON

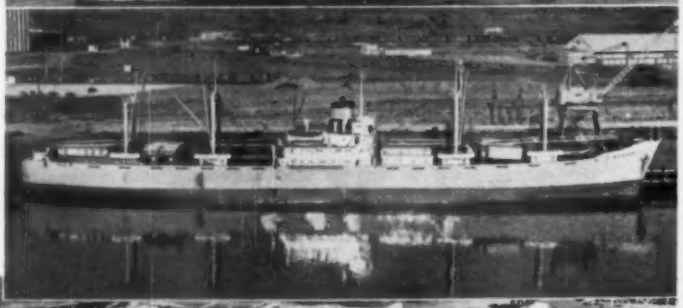
Loaded with Mid-Continent drilling equipment, the S. S. Cambridge pulls away from her Port Houston dock on Nov. 6, 1958. This 10,000-ton freighter arrived in Argentina on Dec. 4 with the first three rigs.

MORE RIGS FOR ARGENTINA

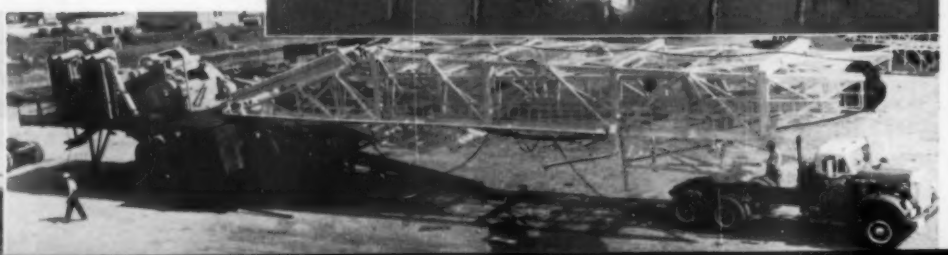
The 10,000-ton S. S. Elderfields steams down Houston's Ship Channel on Nov. 24 with three more Mid-Continent rigs bound for Comodoro Rivadavia, Argentina. This shipment was delivered just after Christmas.

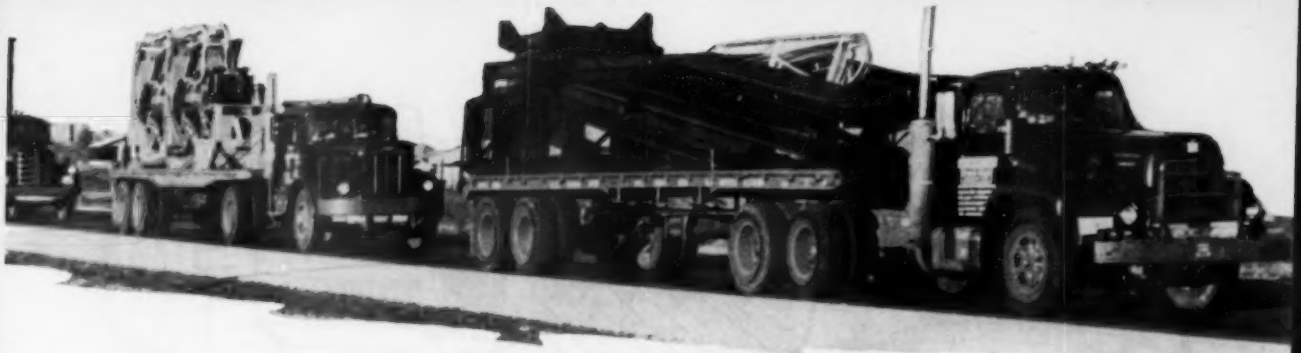
15,000-TON FREIGHTER LOADS UP

When the S. S. Dorian completed loading operations in Houston on Dec. 15, Mid-Continent Supply had shipped ten complete drilling rigs in an unbelievable 60 days! Most of this equipment is now in operation.



MC3-D





DESIGNED, MANUFACTURED ARGENTINA IN 60 DAYS!

...proof Mid-Continent Supply gives fast world-wide delivery!

Ten complete drilling rigs designed, manufactured and shipped in 60 days! This was the delivery feat accomplished by Mid-Continent Supply Co. recently for Loffland Brothers Co. One 15,000-ton and two 10,000-ton freighters were needed to transport the equipment to Argentina, where Loffland is drilling for Pan American International Oil Co.

The rigs, specially-designed and equipped for drilling in Argentina, are diesel-powered, fully-portable units mounted on dual trailers. Mid-Continent U-36-A drawworks, rig drives, rotary tables and blocks, Cummins diesel engines, Emsco pumps and Lee C. Moore masts were supplied for each rig by Mid-Continent. Each rig package also included portable mud tanks, drill pipe, rotary hose, wire line, diesel-powered trucks, and hundreds of other items necessary for efficient foreign drilling operations.

This was one of the biggest movements of equipment ever undertaken in the oil business. It was launched with the shipment of three complete rigs just 30 days after Loffland was assigned the drilling contract. The remaining rigs were shipped in groups of three and four at two-week intervals.

The assembly and shipment of these ten complete rigs in 60 days is further proof that Mid-Continent Supply offers fast, dependable delivery of drilling equipment anywhere in the world. No matter where the job is . . . no matter how big or how small . . . Mid-Continent has complete facilities.

MID-CONTINENT SUPPLY CO.

MID-CONTINENT BUILDING • FORT WORTH, TEXAS

Export Division: 45 Rockefeller Plaza, New York 20, N. Y. Cable: MIDCUMPORT NYK

THE WORLD'S LARGEST INDEPENDENT OIL FIELD SUPPLY COMPANY

Meet the man who started us in business just one hundred years ago

He's Edwin L. Drake—who drilled the world's first commercial oil well in Titusville, Penn.—August 27, 1859

Your business and mine started when Edwin L. Drake decided to drill rather than dig for oil in Titusville. Some men laughed at Drake, some scoffed and others ignored him completely.

But no man questioned Drake's right to try out a new idea or his freedom to work as he chose. In this unique climate of freedom, America's oil industry was born.

Today, one hundred years later, preservation of the freedom to try new ideas and develop new products to win the favor of our customers remains our greatest challenge. Responsible enterprise is still the very foundation of the oil business...as it has been throughout one hundred years of service to the American people.

Oil's one hundredth anniversary offers every oilman the opportunity of a century to tell his neighbors how his business serves them. This is a proud story and we can be proud to tell it during this Centennial year.

1859 1959

OIL'S FIRST CENTURY
-BORN IN FREEDOM
WORKING FOR PROGRESS

COMMITTEE ON PUBLIC AFFAIRS OF THE AMERICAN PETROLEUM INSTITUTE • 50 WEST 50th STREET • NEW YORK 20, NEW YORK

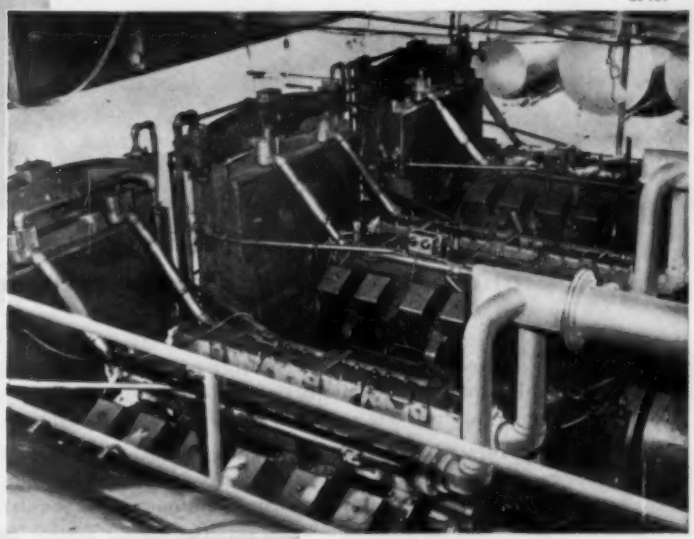
five CLIMAX V-125 ENGINES

power Rig No. 2 of Big Chief Drilling Co.

This Magnolia Petroleum Co. well in the old Cement Field of Caddo County, Oklahoma, was drilled to 20,426 ft. by Big Chief Drilling Co. Rig No. 2. The rig's National drawworks is powered through a compound by three V-125 Climax engines with a combined maximum of 1815 hp . . . and a V-125 Climax engine powers each of the two Gardner-Denver PL-7 mud pumps.

The V-125 Climax is a 3711 cu. in. engine—V-type, 12-cyl., 7-in. bore x 7½-in. stroke—easy to start . . . simple to operate . . . burns natural gas, butane, or propane with equal efficiency, and great economy . . . and its accessibility makes maintenance easy. From its separately cast cylinder blocks with their renewable sleeves to the cylinder heads' high turbulence combustion chambers—V-125 Climax is built for its work and it keeps on working. Send for descriptive bulletin.

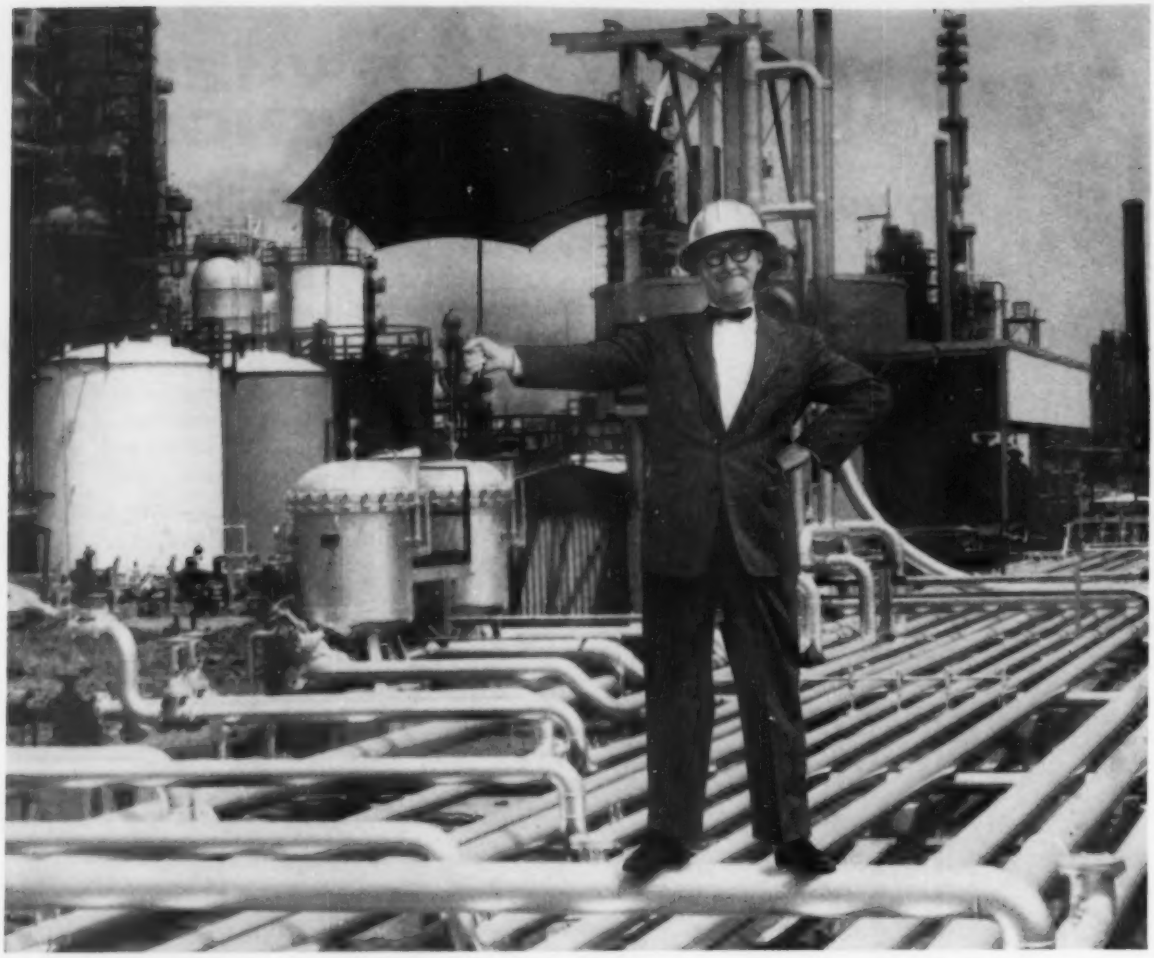
CL 101



CLIMAX ENGINE MANUFACTURING CO.

Factory—Clinton, Iowa

DIVISION OF WAUKESHA MOTOR COMPANY



THERE'S A BETTER WAY... to protect refineries, chemical and industrial plants against corrosion!

Corrosion works overtime on any metal surface that isn't properly protected. Positive corrosion control begins with Glidden Protective Maintenance Coating Systems. They provide *real umbrella protection!*

Glidden Protective Maintenance Coatings are designed to solve specific corrosion and erosion problems. They protect steel, galvanized iron, aluminum, as well as various masonry and wood surfaces.

Here are three examples from the complete line of Glidden Protective Maintenance Coating Systems. NU-PON COTE provides excellent resistance to alkalies, general solvents, abrasion and water. Hi-Heat NEV-A-RUST resists heat up to 1000° F.; protects metal surfaces in high heat areas exposed to weather. VYN-AL offers superior color and gloss retention, and is ideal for color-coating your plant.

As part of the Glidden Protective Maintenance Program, our field engineers will analyze your particular problems and recommend the correct system for positive corrosion control at lowest maintenance cost per year.

Write on your company letterhead for helpful literature and complete information.

"THE GLIDDEN UMBRELLA" of protection combines comprehensive technical service and tested formulations of maintenance coatings for all industry.

QUALITY Glidden PRODUCTS

COATINGS FOR EVERY PURPOSE

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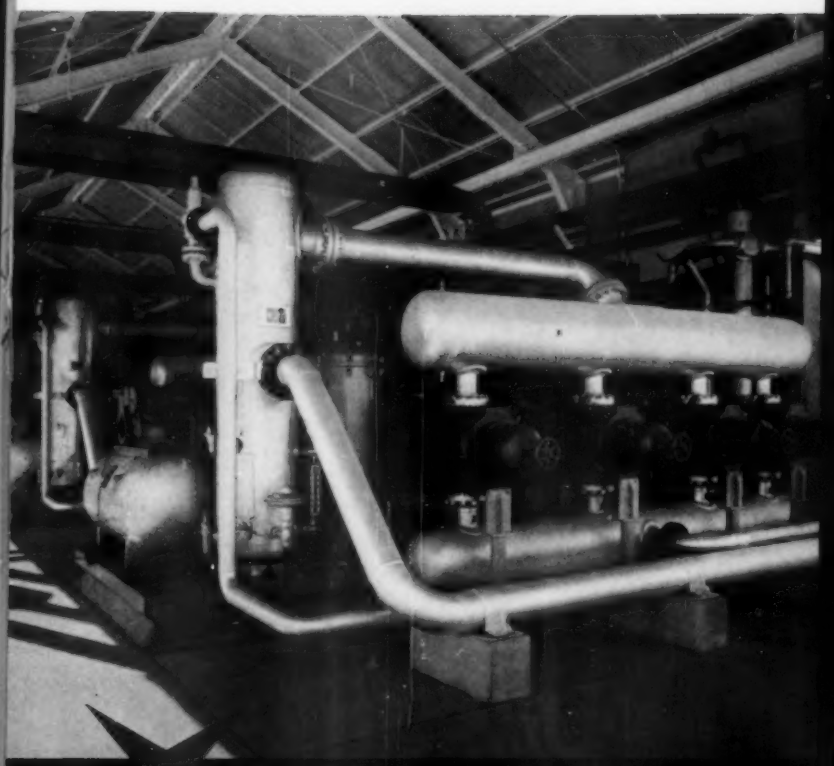
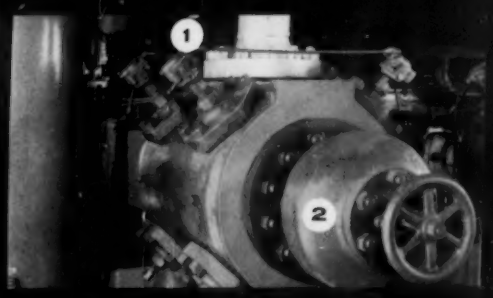
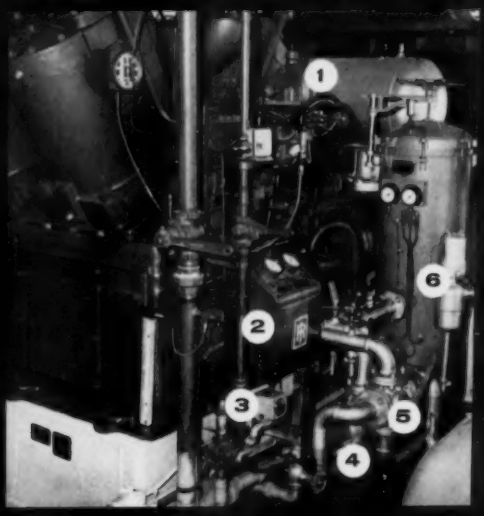
In Canada: The Glidden Company, Ltd., Toronto, Ontario





COMPRESSOR CYLINDERS have (1) automatic inlet valve unloaders and (2) fixed volume clearance pockets. Valve unloaders are combined with automatic engine speed regulations to provide smooth loading and unloading while maintaining desired pressure conditions.



CONTROL CENTER with (1) AS&P controller (2) Engine gauge panel (3) Crankcase oil level valve (4) Three-way oil temperature control valve (5) Triflo four ported oil valve (6) Scrubber liquid level shutdown switch

4-CYCLE DESIGN

INCREASED FLEXIBILITY FOR UNATTENDED STATIONS

660 H.P. BEAIRD-INGERSOLL-RAND packaged compressors in an automatic, unattended gas boosting station. Units are equipped for unattended operation with speed and pressure regulation. Interstage and after cooling sections are mounted in the Young updraft design radiators. Other Beaird compressors available from 120 to 660 h.p.

Complex or partial control systems will not meet the requirements of a modern, automatically operated unattended compressor station. This is why leading operators select Beaird-Ingersoll-Rand 4-cycle packaged compressor for this service.

The 4-cycle design provides smooth power at any load (even with frequent variations), and at any engine speed from full to half. To meet even greater line variations compressor cylinders can be loaded or unloaded in steps from full to no load. Should conditions require the unit to stand by, the 4-cycle engine can be idled for long periods without carbon build up or damage to the valve ports. This is possible because the constant quality fuel mixing valve will handle all speed and load conditions.

Lowest cost per horsepower to install, Beaird-Ingersoll-Rand packaged compressors require minimum foundation and piping . . . can be easily moved to other service.

Beaird gas engineers are available to assist you with your plans on automatically operated field stations.

THE J. B. BEAIRD COMPANY, INC.
Shreveport, Louisiana
A Subsidiary of American Machine & Foundry Company

CHECK THESE EXCLUSIVE 4-CYCLE FEATURES:

Complete engine speed control
Line pressure maintenance by speed regulation
Gas capacity control by speed regulation
Constant quality fuel mix at all speeds
Long spark plug life
Idling for long periods
Small, accessible air intake piping
One air intake and one exhaust connection
No scavenging air manifolds or piping required

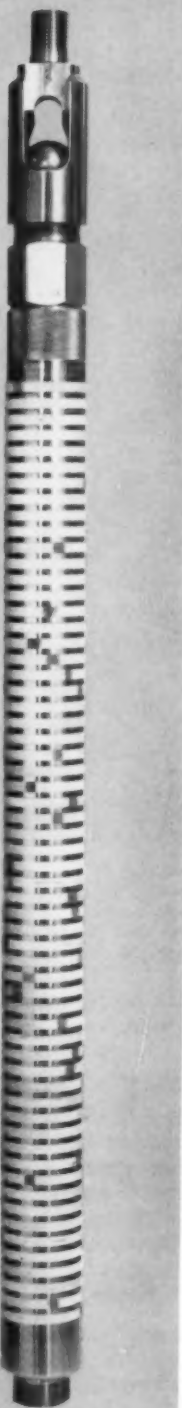
another AMF BEAIRD product

SALES OFFICES: Shreveport, New Orleans, Louisiana • New York, New York • Tulsa, Oklahoma • Houston, Corpus Christi and Midland, Texas and Cie. Ingersoll-Rand, Paris, France.

BEAIRD INTERNATIONAL, INC. SHREVEPORT, LOUISIANA • Sales Offices: Calgary, Alberta, Canada • Caracas, Venezuela.

Metal to Metal Wear...

is the real villain in sucker rod pump troubles. It accounts for most of your repair and pump pulling expense.



The Martin Idea...

for getting away from this trouble has always been to make use of the best available materials — *Natural Rubber* for the key material in plunger rings; *Synthetic Rubber* for the key material in resilient ball guides for cages.

The accurately grooved and drilled metal body of **The Martin Plunger** does not touch the barrel. Only the resilient rubber and duck rings contact the barrel. This material — with its great natural resistance to abrasion as well as its slipperyness-when-wet — has a much slower wearing action on the barrel. Most often your barrel will not need replacing. These rings have an amazing ability to take the kind of abuse that goes with oil well pumping, and this means longer runs. Plunger cost is reduced because replacing the rings costs only about one fourth as much as a new plunger, and this saving is, of course, added to the barrel saving and longer runs.

Patent No. 2,591,174

The Martin Rubber Guide Cage protects the ball from all metal contact except when it rests upon its seat. The ball is protected to such an extent that ball and seat life is usually doubled. The synthetic ball guide and stop cannot beat out because of its resilience. Its life is therefore much greater than any metal and you get this longer cage life in addition to better ball and seat life. The two guides are easily replaced when the occasion does arise.

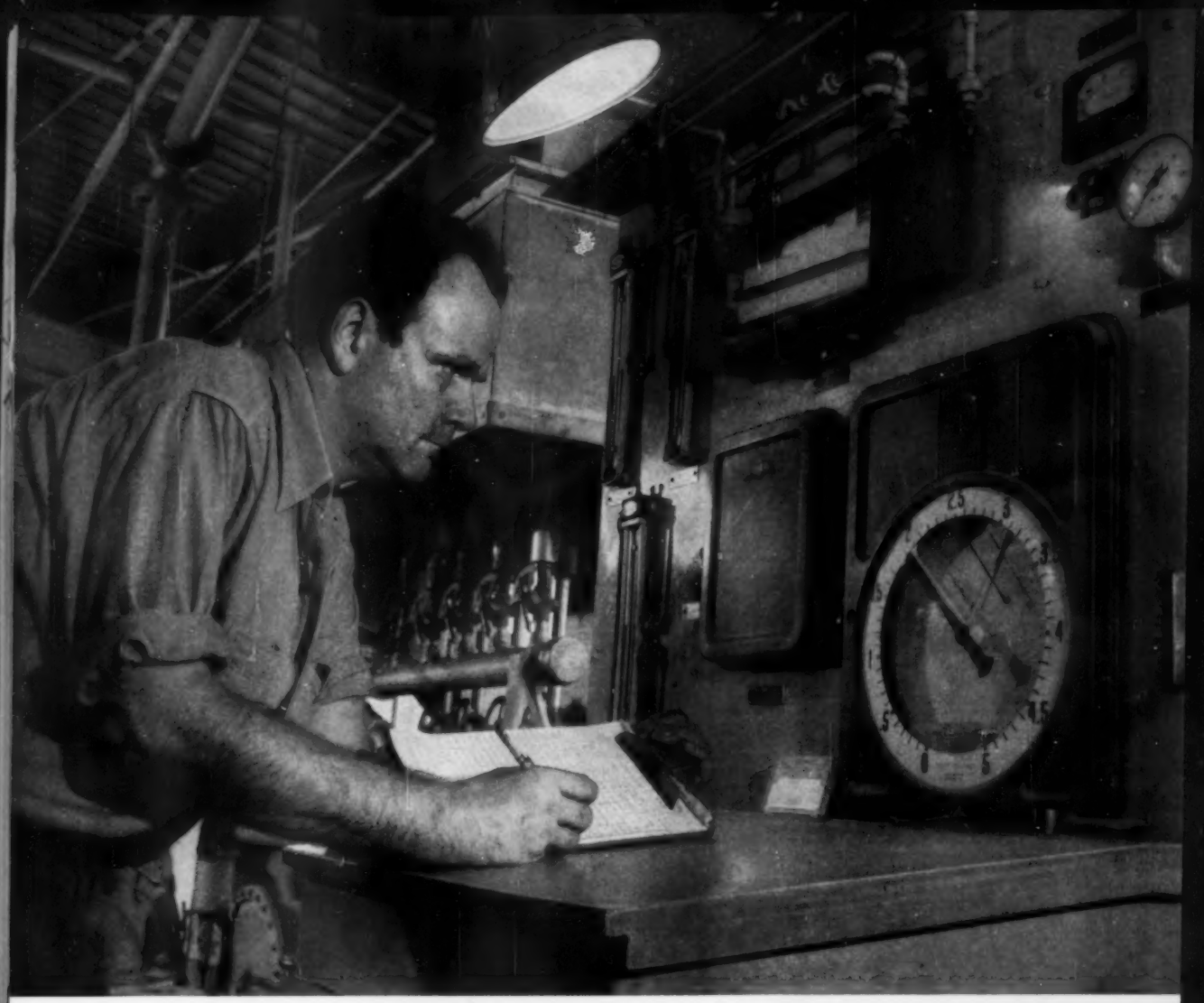
No real capital outlay is required to get these benefits because the cost of Martin Plungers and Martin Cages is very much the same as you are now spending for replacements — sometimes less.

All regular or stroke-thru ROD PUMPS and TUBING PUMPS can be equipped with Martin Plungers. Martin Rubber Guide Cages are made in all sizes and styles. Write for our catalog No. 4; also see Composite catalog for 1956-57.

JOHN N. MARTIN

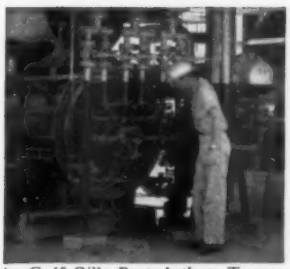
Manufacturer

9 W. BRADY • TULSA, OKLA.



For tested generator performance . . .

Come to Kemp



At Gulf Oil's Port Arthur, Texas refinery, purging inerts are supplied by Kemp Generator and Kemp Dryer working as a team. The units produce 30,000 SCFH for a bountiful and easily controlled supply at low cost.

Tested . . . and proved! Factory tested with rigid component checks, field tested by Kemp engineers at installation, and time tested by years of actual use. Proved that Kemp Inert Gas Generators are built to last, built to produce, built to be accurate.

At the heart of every Kemp Generator is the Kemp Industrial Carburetor, uncomplicated in concept, yet outstanding in performance. It provides sensitive and accurate control of inert analysis. A quick setting of the calibrated dial insures delivery of an unvarying mixture, regardless of line demands.

And Kemp design—rugged, simple, and sturdy—means that maintenance and attendance requirements are kept to a bare minimum. Kemp Inert Gas Generators stand up under the toughest conditions, yet produce with complete dependability.

To get detailed information and ideas, give your Kemp Representative a call. Or write us direct for Bulletin I-10. THE C. M. KEMP MFG. Co., 405 East Oliver St., Baltimore 2, Maryland.

Convection Dryers

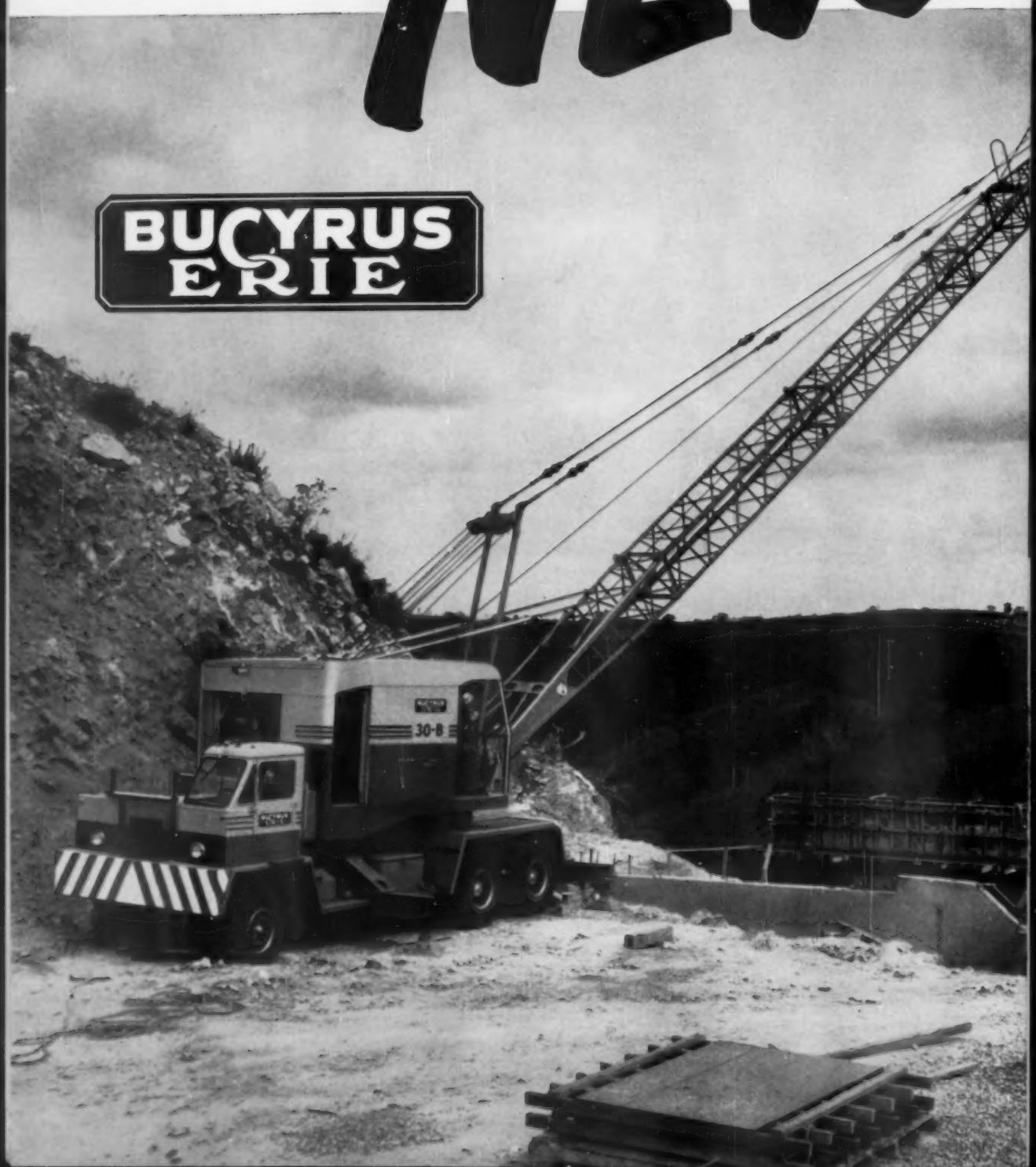
Atmos Generators

KEMP BALTIMORE

Nitrogen Generators

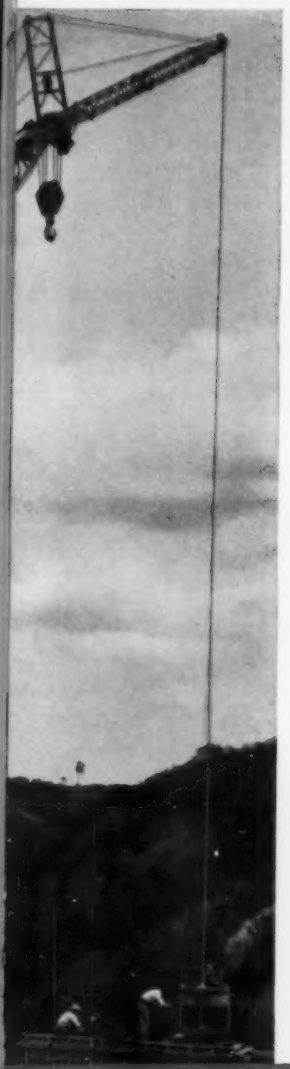
Oriad Dryers

NEW



45-TON CAPACITY

30-B transit crane



Here's the big, new Bucyrus-Erie 30-B Transit Crane — designed to give you the *best* lifting crane in its class plus the tops in digging advantages as a 1-yd. hoe, shovel, dragline or clamshell. It's loaded with profit-boosting, cost-cutting improvements:

INCREASED LOAD CAPACITY AT GREATER RADIUS— With a 40-ft. boom, the 45-ton maximum allowable load can be lifted at radius of 15 feet.

NEW BOOM — The crane boom, fabricated of high-strength alloy steel, is designed with heavier chord angles and larger cross sections.

ANTI-FRICTION MOUNTING FOR POINT SHEAVES— Point sheaves are mounted on pre-lubricated, sealed, anti-friction bearings.

AIR-OPERATED BOOM HOIST AND ENGINE MASTER CLUTCH have been added to the 30-B's already convenient, quick-response, air-control system.

ADJUSTABLE CONE ROLLERS provide proper clearance between rollers and roller path. Rollers are also fitted with long-life, heavy-duty bushings to handle the greater roller loads.

BIG, RUGGED, 6 x 4 or 8 x 4 CARRIER, specially designed and built for fully convertible crane-excavator service, is available with gas or diesel engine.

You'll like these NEW features, too!

★ TWO-SPEED GEAR BOX (special)

★ SINGLE-PIECE COUNTERWEIGHT

★ PENDANT SUSPENSION WITH 12-PART TACKLE

★ BOOM ANGLE LIMIT CONTROL (extra)

★ LOWER OVER-ALL HEIGHT

send in coupon

. . . to get the complete story on how the new 30-B Transit Crane adds up to the soundest equipment investment you can make TODAY.

BUCYRUS ERIE ®

Builds Better Equipment

BUCYRUS-ERIE COMPANY
South Milwaukee, Wisconsin

Gentlemen:
I'd like more information on the new 30-B Transit Crane.

NAME.....

COMPANY.....

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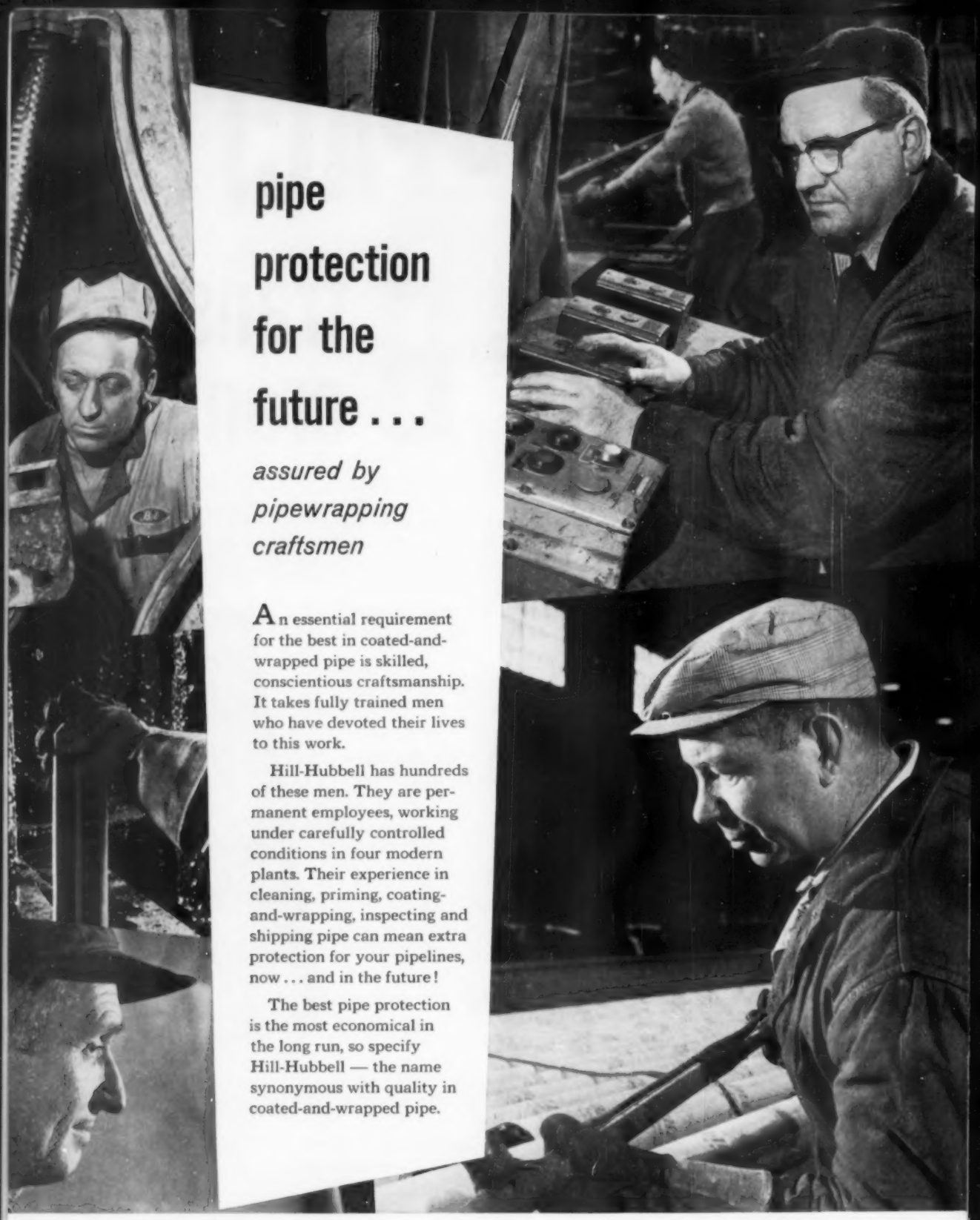
CITY..... STATE.....



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An essential requirement for the best in coated-and-wrapped pipe is skilled, conscientious craftsmanship. It takes fully trained men who have devoted their lives to this work.

Hill-Hubbell has hundreds of these men. They are permanent employees, working under carefully controlled conditions in four modern plants. Their experience in cleaning, priming, coating-and-wrapping, inspecting and shipping pipe can mean extra protection for your pipelines, now . . . and in the future!

The best pipe protection is the most economical in the long run, so specify Hill-Hubbell — the name synonymous with quality in coated-and-wrapped pipe.

Specify Hill-Hubbell wrapped pipe on your next job . . .

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FACTORY APPLICATORS OF COATINGS AND WRAPPINGS

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They Say—

Who moved Halifax?

Dear Sir:

I refer you to the chart ("Canadian Pipelining,") on page 84 of your January 19 issue. The pipeline which you indicate is going to Halifax, Nova Scotia, is actually shown going into the province of Newfoundland, rather than Nova Scotia.

C. W. Jackman
Statistician
Dept. of Mines and Minerals
Province of Alberta
Edmonton.

Dear Sir:

This article is good but the geography is poor. The section you call Newfoundland is actually Labrador. You have shown the possible pipeline going to the province of Newfoundland when it should be Halifax, Nova Scotia.

E. L. Weiss
Mechanical Superintendent
North Star Oil, Ltd.
Winnipeg.

Dear Sir:

This really shouldn't happen to you —after all the care you take, but it did. I'd be interested to know how it happened.

K. A. Olson
Phillips Petroleum Co.
Calgary.

(Editor's note: One red-faced artist is studying Canadian geography at night this week.)

Another view of India's oil

Dear Sir:

The article by Henry Carter Rea of Denver on the petroleum situation in India (Nov. 24, 1958, p. 62) presents a rather one-sided view of the Indian oil industry.

Mr. Rea gives the opinion that petroleum production and exploration in India are totally dominated by the Communists. We feel that this is considerably exaggerated.

The Russians and Rumanians have constantly underbid comparable U. S. and Western European firms on the exploration program, and India, with its neutralist policy, has accepted them. True, the Russians and their affiliates are probably deliberately underbidding in order to obtain a foothold in India, but to say that the Communists completely control the situation is a fallacy.

The purchase of crude and refined products represents one of the largest drains of India's very meager foreign exchange fund and for this reason is watched with suspicion. One of the greatest desires and needs of the Indian Government is to rectify the foreign exchange situation and obtain some sort of equilibrium. As a result, Indians in general regard the operations of the international oil companies as being entirely arbitrary and cartel-inspired and that excessive profits are being realized at the expense of oil-short countries such as India.

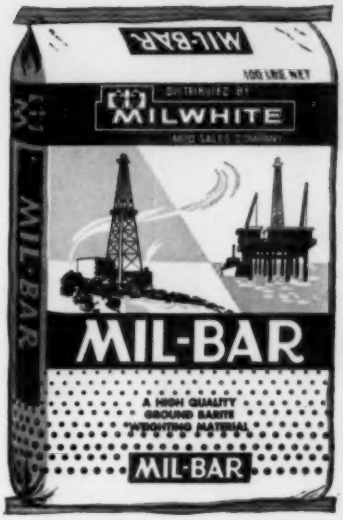
Referring to regulation of the oil industry in India . . . Rea says "the Indian constitution contains a nationalization law which places the oil industry under government operation. All industrial production, distribution, and prices are regulated by law." This is definitely not true.

The oil industry is far from under government operation at the present time in India, although the central government is empowered to make laws regulating the development of oil resources to such an extent deemed expedient to the interest of the people. So do other democratic governments. True, there is a government bureau to which operations of the industry must be reported. In some respects this resembles the FPC regulatory powers in this country. Accordingly, if the Indian approach is socialistic, so is ours.

Mr. Rea's statement as to the arbitrary rejection by the Indian Government of his recommendation to increase Assam production and move the crude to Calcutta is another statement out of context.

Actually, India would more than welcome increased production of Assam crude if the economics were favorable, i.e., would not result in increased prices for products. The proposed pipeline to Calcutta would be a heavy drain on foreign exchange and on the basis of the proved reserves at the present time would be very risky.

At the present there is no refinery in Calcutta, let alone a 60,000 bbl. per day operation. The nearest refinery to Calcutta is at Visakhapotnam, midway between Madras and Calcutta. Other refineries are located in Bombay. Accordingly, a new refinery



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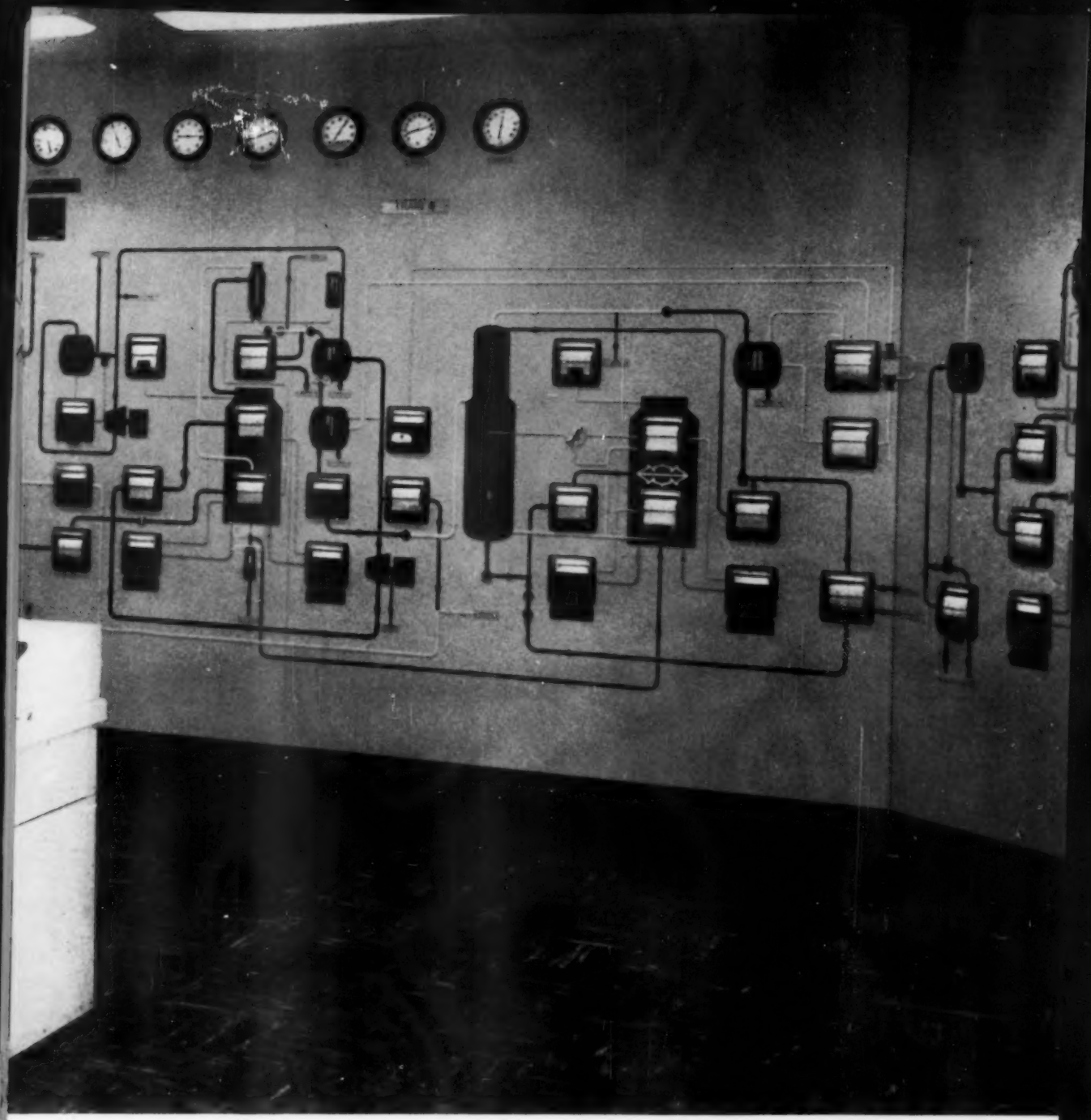
HOUSTON, TEXAS
A DIVISION OF MISSISSIPPI RIVER FUEL CORPORATION

"readability and flexibility—that's why we specified

reports S. Edward Roth,
Chief Instrument Engineer,
Tidewater Oil Company
Delaware Refinery

It's the full-scale, vertical, 4-inch strip chart that makes a pneumatic Consotrol instrument so easy to read—even from a distance. 33% larger than most small-case instrument charts. An important difference in large control centers where operators "sweep" as many as 100 instruments at a time.

As for "flexibility", Foxboro Consotrol instruments stand out in two ways. One—because of the Model 58 Controller's 500% proportional band—the widest proportional band of any small case controller—and its reset and derivative units, which easily plug-in with *no* re-calibration necessary. Operators find these fea-



pneumatic Consotrols* for our new Tidewater Refinery"

tures especially helpful when "tuning" controllers to a new process.

And second—at the Tidewater Control Center shown here, there are 1, 2, and even 3-pen recorders; 1 and 2-pointer indicators; as well as recorders and indicators with integrally-mounted Model 58 Consotrol Controllers.

"Readability and flexibility"—plus day-in, day-out dependability of control. You get them all with Foxboro Consotrol instruments. Write for Bulletin 13-18—it has all the details. **The Foxboro Company, 602 Norfolk Street, Foxboro, Massachusetts.**

*Reg. U. S. Pat. Off.

SHOWN ABOVE: Graphic control panel for catalytic desulfurizer unit, Tidewater Delaware Refinery. Over 400 Foxboro Consotrol Instruments are used in this ultramodern refinery.

FOXBORO

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CONSOTROL INSTRUMENTATION

NEW! AiResearch split-flapper check valve

The new AiResearch Split-Flapper Check Valve provides an exceptionally clean flow of any gas or liquid through the valve area. It achieves very fast closure with no leakage in the return flow.

This extremely compact, lightweight unit has important applications in petroleum, chemicals, paint, food processing, missile fuels . . . any industry with a gas or liquid flow problem. The valve can be made from various materials, covering an operational temperature range from cryogenic levels to 1700° F.

The AiResearch Split-Flapper Check Valve pictured above is made of aluminum . . . rugged and dependable with only two moving parts. Twin forged flappers, opening in the direction of normal flow, are supported through the center of the piping. In the event of backward flow, their spring mounting and aerodynamic design assure fast closure of the valve.

Insertion of short flapper plates through the bore eliminates exterior bonnet and gasket joint and reduces length. Other structural advantages are better support of the plates, greatly reduced shock loads on the hinges and sealing surfaces, reduced springload, less mass and material to be heated or cooled by the flow element.

Ideal for portable as well as stationary applications, the new AiResearch Split-Flapper Check Valve can accommodate lines 1 to 12 inches in diameter. AiResearch has 17 years of experience in the production of valves and controls.

Your inquiries are invited.

THE GARRETT CORPORATION

AiResearch Industrial Division

9225 South Aviation Blvd., Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND SPECIALIZED INDUSTRIAL PRODUCTS

would have to be constructed or the oil transshipped.

Mr. Rea is quoted as saying "the Socialist government of India is working for the things we abhor and is using our money to further entrench their own ideas. We are defeating ourselves."

It is my strong opinion that Mr. Rea is comparing the Indian situation with the rather unique economic structure of the U. S. The social and economic structure of India differs greatly from the U. S. The way of doing business, availability of private capital, natural resources, educational levels, etc., cannot be compared on the same basis. What country could mirror the U. S. in 10 years?

The present Indian Government is by far the most democratic (U. S. definition) in that area of the world and is attempting literally to pull up India by its boot straps, and to do this in a reasonably democratic atmosphere is one of the most formidable tasks that any country has faced.

I would definitely suggest that there should be a counter article in The Oil and Gas Journal which would correct the slanted viewpoint as given in the article under discussion. In my estimation, you are doing the U. S. a disservice by presenting the situation in the light that it was done.

Benjamin A. Lambert
Arthur D. Little, Inc.
Cambridge, Mass.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

FEBRUARY

11-13 Southwestern Legal Foundation, tenth annual institute on the law of oil, gas, and taxation, Southwestern Legal Center, Dallas.

11-13 National Association of Corrosion Engineers, Tulsa section, tenth annual pipeline corrosion short course, Mayo Hotel, Tulsa.

15-19 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, Sir Francis Drake Hotel, San Francisco.

16-18 American Management Association, seminar on management problems of exploration and production, Hotel Astor, New York.

18-21 National Society of Professional Engineers, winter professional meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala.

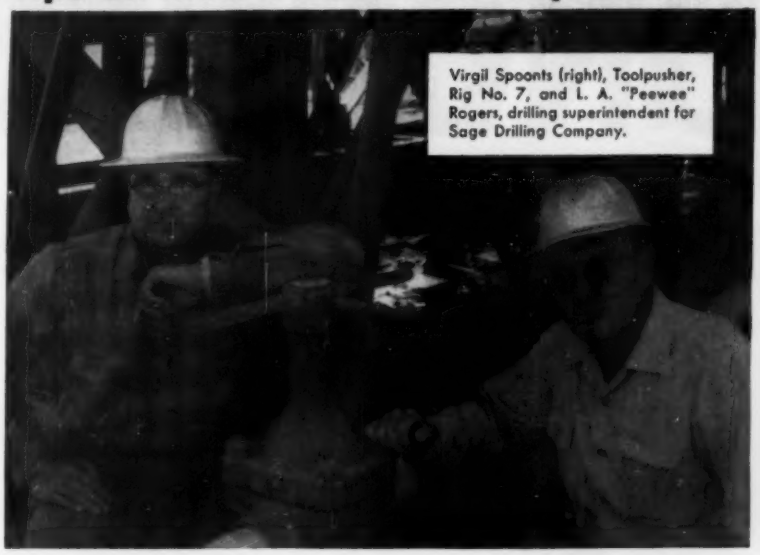
24-25 University of Oklahoma, sixth geological symposium, Norman, Okla.

24-26 Oklahoma State University, natural-gas engineering conference, Stillwater, Okla.

25 Petroleum Equipment Suppliers Association, Mid-Continent and Rocky Mountain district meeting, Mayo Hotel, Tulsa.

26 American Society for Testing Ma-

Tips on Mud Valves for Toolpushers...



Virgil Spoonts (right), Toolpusher, Rig No. 7, and L. A. "Peewee" Rogers, drilling superintendent for Sage Drilling Company.

Our Mudwonder Valves just *don't* sand up!

by Virgil Spoonts, Toolpusher, Rig #7
Sage Drilling Company, Blanding, Utah

"I'VE used a lot of different mud valves in 10 years of toolpushing. Used to be, I'd have to baby them along . . . operate the standpipe valve every day or so to keep 'em flushed out. If I didn't, they'd sand up so bad I'd need a 36-inch wrench to close them.

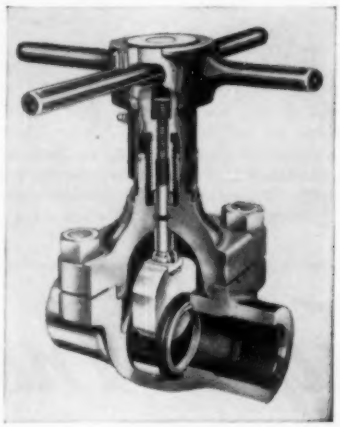
"But not with Mudwonders. I've never had one jam up with sand in the seat. As soon as I bring the gate down close, the flow sluices all sand out of the way. I close 'em hand-tight and they hold. Never need a wrench.

"We rigged up new with Mudwonders on Number Seven. 17 two-inchers and 4 of the four-inch size. Since we started drilling, in August, 1957, we've had to repair only one of them. It was used on jet and hadn't been properly closed. But it's real easy to put in a new insert—or even a gate—without disturbing any connections.

"Lack of downtime is mighty important to us. We've had *no* lost time due to Mudwonders, except the ten minutes it took to repair the one I mentioned. Parts are no problem, either. We just keep a couple of seat inserts and an extra gate on hand for each size—how's *that* for inventory control?"

Mudwonder valves are built in 2", 3" and 4" sizes; with screw or flange ends; for 2000 psi WP (4000 psi test) and 3000 psi WP (6000 psi test) service. See your favorite oil field supply store, or write Edward Valves, Inc., East Chicago, Indiana, subsidiary of Rockwell Manufacturing Company.

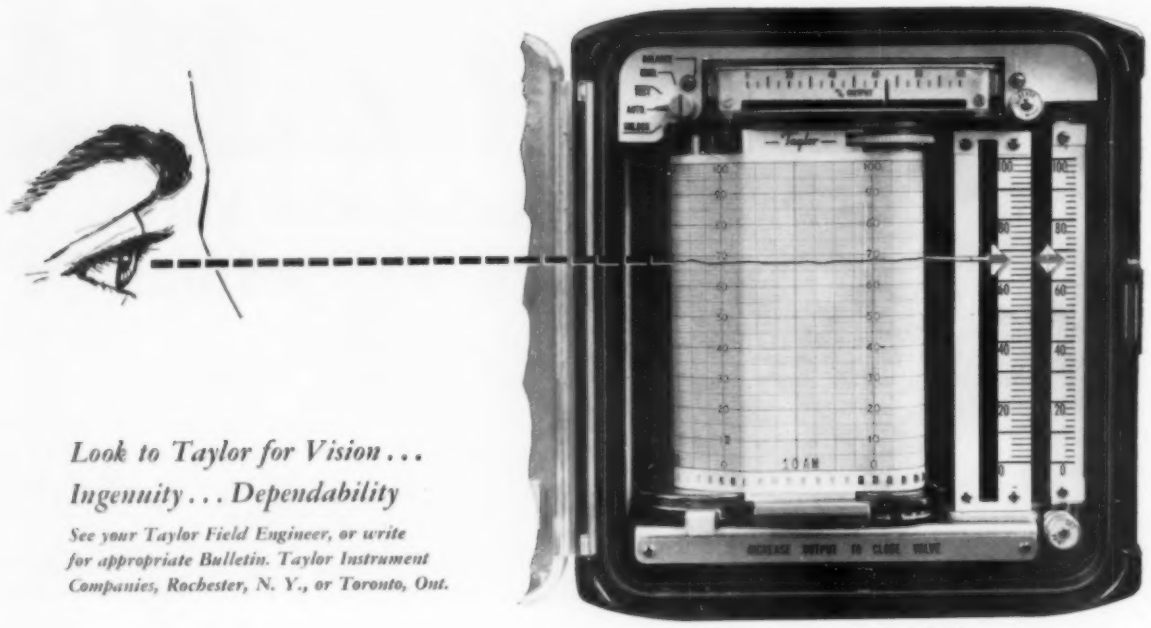
Mudwonder cut-away view shows the one-piece seat insert, with Buna-N molded integrally over steel wear rings; chromed gate with "T" slot connection; separated stainless stem and double thread construction.



(Advertisement)

UNCONFUSED

in both Electronic and Pneumatic



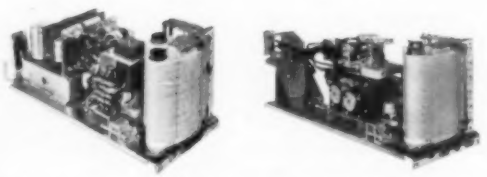
Look to Taylor for Vision . . .
Ingenuity . . . Dependability

See your Taylor Field Engineer, or write for appropriate Bulletin. Taylor Instrument Companies, Rochester, N. Y., or Toronto, Ont.

701J AC or DC Electronic Recorder

Compare these features . . . common to the 701J Electronic

1. A Taylor 'first'. On both Electronic (left) and Pneumatic (right) instruments, controller response adjustments are quickly and easily made from the front, where results can be watched. You can visualize immediately all pertinent process information — chart, pen and set-point.



2. All major components plug in. Even individual amplifier circuits plug in. You can service all components and still stay on control. AC and DC Recorders are completely transistorized; unaffected by a supply voltage change up to ±10%.

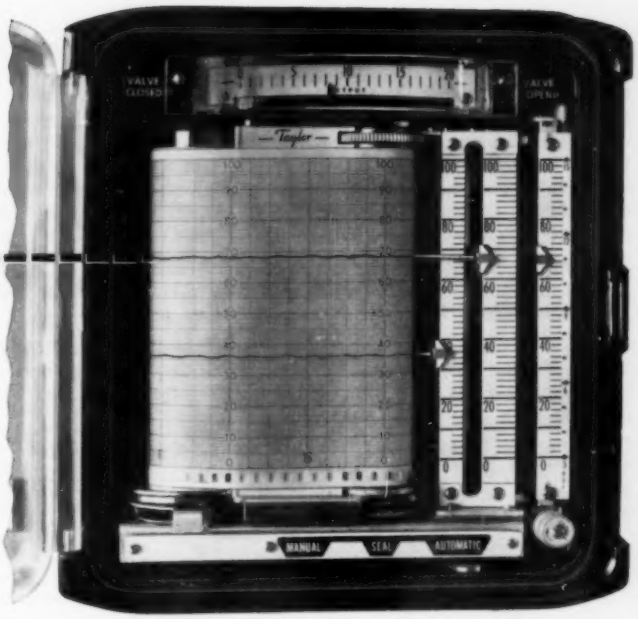
Taylor Instruments

READABILITY

instrumentation by Taylor

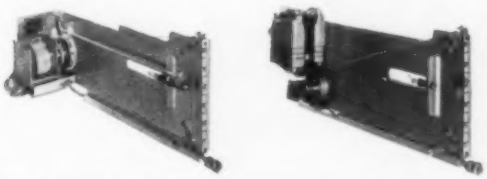
- **Simplest scanning of all** . . . because chart record, pen and set-point are side-by-side.
- **Invites frequent reading** . . . because target-type pens and pointers are easiest of all to see, even at a distance.
- **Operators make fewer mistakes** . . . because all pertinent data is lined up.
- **You read the 4″ chart** from left to right—like a newspaper—on rectilinear coordinates.
- **All these features** in a 6″ x 6″ cutout.

*Reg. U.S. Pat. Off.



90J TRANSCOPE Pneumatic Recorder*

AC or DC Recorder and the 90J TRANSCOPE Pneumatic Recorder



3. Plug-in Set Point Transmitters, parallel to and exactly matching chart range, permit comparison without confusion and accurate adjustment of the control point. They can be removed for checking with only momentary interruption of record.

4. Powerful Servo Motors give more precise pen positioning than ever before. More accurate records. Unmatched threshold sensitivity. Unparalleled power permits use of process alarms, new inking system and elimination of flimsy linkage.

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In the states of Michigan, Ohio, Iowa, West Virginia, Illinois, Pennsylvania, and New York, there are thousands of gas storage wells similar to the one shown below. They may be hooked up differently according to the operator's needs — but 80% of these gas storage wells are controlled with Orbit Valves. This is not accidental by any stretch of the imagination — gas distributing companies must be in a position to deliver large volumes of gas during winter months. Valves, by necessity, must be dependable. Orbit Valves meet the qualifications for this all-weather tough service, they will not freeze up.

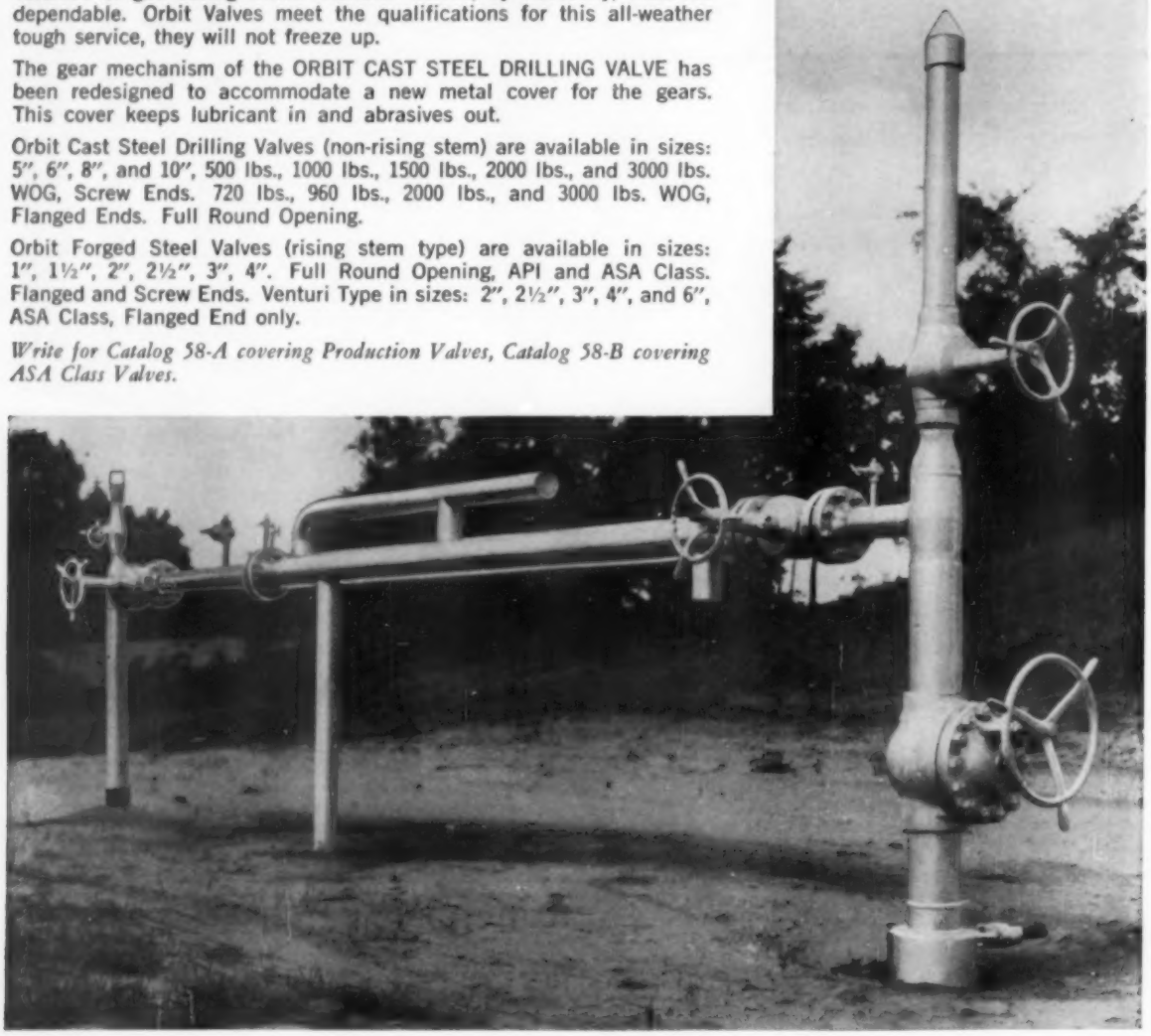
The gear mechanism of the ORBIT CAST STEEL DRILLING VALVE has been redesigned to accommodate a new metal cover for the gears. This cover keeps lubricant in and abrasives out.

Orbit Cast Steel Drilling Valves (non-rising stem) are available in sizes: 5", 6", 8", and 10", 500 lbs., 1000 lbs., 1500 lbs., 2000 lbs., and 3000 lbs. WOG, Screw Ends. 720 lbs., 960 lbs., 2000 lbs., and 3000 lbs. WOG, Flanged Ends. Full Round Opening.

Orbit Forged Steel Valves (rising stem type) are available in sizes: 1", 1½", 2", 2½", 3", 4". Full Round Opening, API and ASA Class. Flanged and Screw Ends. Venturi Type in sizes: 2", 2½", 3", 4", and 6", ASA Class, Flanged End only.

Write for Catalog 58-A covering Production Valves, Catalog 58-B covering ASA Class Valves.

This Gas Storage Well is located 10 miles west of Big Rapids, Michigan.



terials, southwest district annual meeting, Houston.

26-28 Pipe Line Contractors Association of Canada, fifth annual convention, Castle Harbour Hotel, Bermuda.

27 Natural Gasoline Association of America, Permian basin regional meeting, Scharbauer Hotel, Midland, Tex.

MARCH

3 Petroleum Equipment Suppliers Association, Pacific district, annual membership meeting, Ambassador Hotel, Los Angeles.

4-5 University of Oklahoma, gas-processing conference, Norman, Okla.

4-6 American Petroleum Institute, Division of Production, southwestern district meeting, Hotel Scharbauer, Midland, Tex.

5-6 Southern Gas Association, transmission management conference, Jung Hotel, New Orleans.

6 Natural Gasoline Association of America, Gulf Coast regional meeting, Robert Driscoll Hotel, Corpus Christi, Tex.

7 American Chemical Society, Oklahoma tetrasectional meeting, University of Tulsa, Tulsa.

8-11 American Society of Mechanical Engineers, gas turbine power conference and exhibit, Netherlands-Hilton Hotel, Cincinnati.

9-11 Midwest Gas Association, annual meeting, Hotel Fort Des Moines, Des Moines.

11 Petroleum Equipment Suppliers Association, southwestern district, annual membership meeting, Shamrock Hilton Hotel, Houston.

13 American Institute of Chemical Engineers, Sabine area section; American Chemical Society, Texas-Louisiana Gulf section; sixth annual joint technical meeting, Lamar State College of Technology, Beaumont, Tex.

16-18 Western Petroleum Refiners Association, forty-seventh annual meeting, Hilton Hotel, San Antonio, Tex.

16-19 American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, forty-fourth annual meeting, Memorial Auditorium, Dallas.

16-20 National Association of Corrosion Engineers, fifteenth annual conference, Hotel Sherman, Chicago.

17-18 Manufacturing Chemists' Association, air and water-pollution abatement conference, Netherlands Hilton Hotel, Cincinnati.

18 Petroleum Equipment Suppliers Association, eastern district, annual membership meeting, Duquesne Club, Pittsburgh.

19-20 New England Gas Association, annual meeting, Hotel Statler, Boston.

21 North Texas Oil and Gas Association, twenty-ninth annual meeting, Kemp Hotel, Wichita Falls, Tex.

23-24 University of Oklahoma, second conference on theory of fluid flow through porous media, Norman, Okla.

25-27 American Petroleum Institute, Division of Production, southern district meeting, Roosevelt Hotel, New Orleans.

31 Seventh annual meeting, Philadelphia-Wilmington section of American Institute of Chemical Engineers, and University of Pennsylvania, Philadelphia.

29-Apr. 2 American Society of Mechanical Engineers, instruments and regulators

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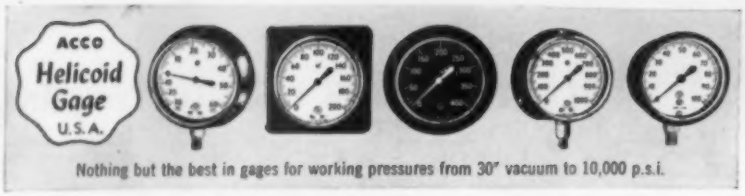

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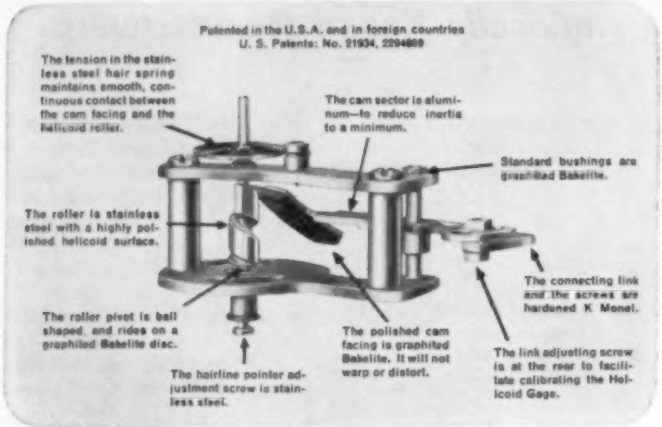
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division conference, Case Institute of Technology, Cleveland.

APRIL

2-3 Society of Petroleum Engineers of AIME, Rocky Mountain petroleum section, Casper, Wyo.

2-3 American Institute of Mining, Metallurgical, and Petroleum Engineers, technical conference on stress corrosion, Mellon Institute, Pittsburgh.

2-6 Geological Society of America, Cordilleran section, annual meeting, University of Arizona campus, Tucson.

5-10 American Chemical Society, national meeting, Boston.

5-10 Engineers Joint Council, nuclear congress, Cleveland Auditorium, Cleveland.

6-7 Instrument Society of America, second national symposium on chemical and petroleum instrumentation, St. Louis.

7-8 Sixth Gas Compressor Institute, sponsored by University of Kansas and Southwest Kansas petroleum industry, Randall's Cafeteria, Liberal, Kans.

8-10 American Petroleum Institute, Division of Production, eastern district meeting, Penn-Sheraton Hotel, Pittsburgh.

14 Independent Oil Men's Association of New England, annual meeting, Hotel Statler, Boston.

14-16 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman.

15-17 National Petroleum Association, semi-annual meeting, Hotel Cleveland, Cleveland.

15-17 American Petroleum Institute, Division of Transportation, annual tanker conference, Jung Hotel, New Orleans.

16-17 Rocky Mountain Oil and Gas Association, midyear meeting, Casper, Wyo.

18-22 Petroleum Equipment Suppliers Association, twenty-fourth annual meeting, Boca Raton Hotel and Club, Boca Raton, Fla.

19-23 American Society of Mechanical Engineers, oil and gas power conference and exhibit, Shamrock-Hilton Hotel, Houston.

22-24 American Petroleum Institute, Division of Production, Mid-Continent district meeting, Herring Hotel, Amarillo, Tex.

22-24 Natural Gasoline Association of America, thirty-eighth annual convention, Baker and Adolphus Hotels, Dallas.

23-24 Sixth annual West Texas oil lifting short course, Texas Technological College, Lubbock, Tex.

24-25 Society of Economic Paleontologists and Mineralogists, Pacific Coast section, annual spring field trip, Boulder Creek area of Santa Cruz Mountains, California.

26-28 Texas Independent Producers and Royalty Owners Association, membership meeting, Baker Hotel, Dallas.

27-28 Society of Exploration Geophysicists, annual midwestern meeting, Cortez Hotel, El Paso, Tex.

29-30 Western Petroleum Refiners Association, Southwest regional technical-industrial relations meeting, Hotel Paso del Norte, El Paso.

29-30 Pacific Coast Gas Association, operating section, transmission conference, El Mirador Hotel, Palm Springs, Calif.

30-May 1 American Petroleum Institute, Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles.

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HERCULES STUFFING BOXES end Your pumping worries*

HERCULES Duplex Polished Rod Stuffing Boxes are constructed from high grade malleable iron (55,000 PSI Tensile Strength) and are rated 3,000 pound test. Flexibility and the cone-shaped Packing Rings are the combination of factors which make the HERCULES Stuffing Box without equal for any pumping situation.

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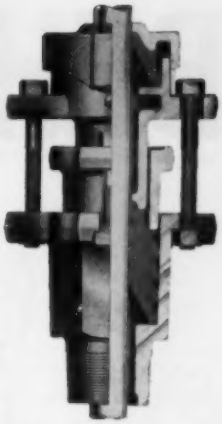
"REGULAR TYPE" DUPLEX POLISHED ROD STUFFING BOX

The old reliable; tried and proved on thousands of wells from coast to coast and in many foreign fields.



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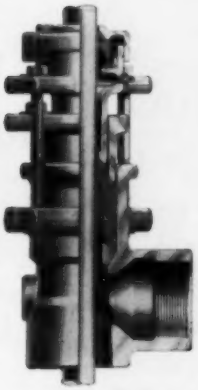

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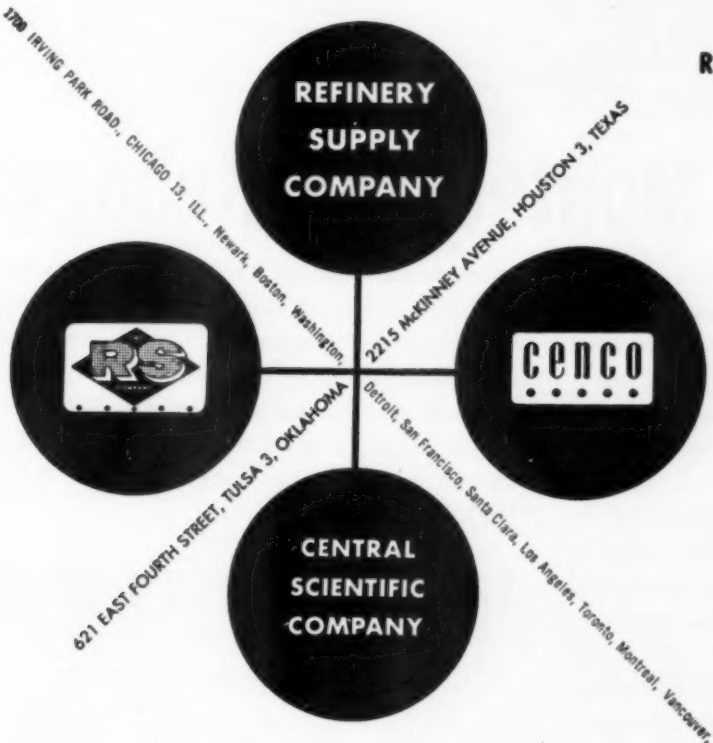
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This instrument is based on the principle of generation of pressure by application of a known weight to a hydraulic piston on known area. Conversely, an unknown pressure can be measured by balancing its force on a piston of known area with a known weight—the result is extremely accurate pressure readings.

BEHIND THE NEWS

* * *

SunOlin to Build $10 Million Urea Manufacturing Plant

PHILADELPHIA — A urea manufacturing plant to be built by a newly-formed concern jointly owned by Sun Oil Co. and Olin Mathieson Chemical Corp. will cost between $10 million and $11 million, Sun disclosed here.

Sun and Olin Mathieson announced formation of the concern, called SunOlin Chemical Co. last July, and said then a plant would be constructed to make urea adjacent to Sun's Marcus Hook, Pa., refinery. A Sun spokesman said the site selected adjoins the Marcus Hook refinery but is just across the Pennsylvania border in Delaware.

The plant will have capacity to produce about 73,000 tons of urea a year, for use in making chemicals, fertilizer and cattle feed. Construction is scheduled to begin next spring.

Process by Montecatini-Kellogg!

First news release on SunOlin's new urea plant was the above announcement from the Wall Street Journal, December 23. Back of this story is that SunOlin Chemical Company will use a Montecatini-Kellogg Liquid Recycle Process, and that Kellogg will build this new 222-ton/day urea plant.

SunOlin's selection of the Montecatini-Kellogg route for its initial venture into a highly competitive market is significant recognition of the economics involved. Among the many advantages in this instance are: (1) Low initial investment; (2) Low operating costs and corrosion-free maintenance; (3) Complete conversion of the ammonia and carbon dioxide feeds; (4) High purity product, with biuret content less than one per cent; (5) Low-moisture, free-flowing prills without drying or coating operations.

Kellogg is privileged to participate in this new undertaking for SunOlin. If *you* are interested in urea, complete information on the Montecatini-Kellogg Processes may be obtained by writing Kellogg's Contract Sales Division for its recent brochure.

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JOURNALLY SPEAKING

Squeeze Stations

IF GASOLINE prices go up any higher, service stations should change their name to squeeze stations.

That was the name the Chinese gave, about a century ago, to the tax-collecting stations local governments established along the highways to exact tribute from all travelers.

The American motorist is already getting badly squeezed at the filling station, and he may be in for a lot more squeezing. Both the federal and half the state governments are contemplating boosting their gasoline-tax rates. If these are enacted, tax collectors will be grabbing off 50% of the money a motorist pays for a tankful of gasoline at many places.

That's an extortionate tax rate by anybody's standards. We're glad to see that there is the beginning of a popular revolt against higher gasoline taxes. Highway users have been too docile too long. As someone observed, it's hard to believe that this nation was established to escape taxation.

The Chinese feudal lords who set up the squeeze stations never heard of gasoline, and neither did other ancient peoples, but nicking travelers has been a favorite device of tax collectors since the dawn of recorded history. Taxes were imposed on chariots in Rome, on palanquins carried by coolies in the Far East, and on hackney coaches in England.

Nobody knows the origin of the age-old conflict between tax collectors and taxpayers, but it was clearly recognized at least 35 centuries ago. According to the National Geographic Society, a clay tablet was unearthed on the site of ancient Sumer, near the reputed location of the Garden of Eden in what is now Iraq, and when the cuneiform writing was deciphered it revealed this sage observation: "You can have a lord, you can have a king, but the man to fear is the tax collector."

That is every bit as true today as it was then. Today the man most feared by the oil industry is the gasoline-tax collector. And with good reason. For if taxes push the price of gasoline much higher, motorists will find ways to use less of it. And a decrease in the per capita consumption of gasoline would knock the underpinnings out from under the entire economic structure of the oil industry.

Another tax truism is directly applicable here, this one from English common law: "The power to tax is the power to destroy." There is a story that a lawyer once quoted this phrase during an argument before the Supreme Court of the United States, and one of the learned Justices interjected "—not while this court sits."

But unfortunately the Supreme Court can't do anything to keep gasoline taxes from destroying the oil and automotive industries. The only recourse is the supreme court of the people, through a revolt of the motorists.

A more recent and more crass maxim on taxing was coined by a cynical American politician who remarked that taxation is the art of plucking the most feathers with the fewest squawks from the goose. Today's motorist is already plucked pretty bare, and if he expects to save his tail feathers he had better stop being a goose and start squawking loud enough for all legislators to realize he means business.

Perhaps it wouldn't be so bad if all highway taxes, and even the new ones proposed, were applied exclusively to building and improving highways. At least the highway users would be getting something tangible for the tax bite, and this might stimulate travel sufficiently to prevent the threatened decline in gasoline consumption. But at present a large portion of the 7 billion dollars a year that motorists are currently forking over at highway squeeze stations is being spent for things entirely unrelated to highways.

Through such devices as an incident in Boston Harbor and brewing a substitute from sassafras bark, our illustrious forebears reduced their tea consumption so much that England lost not only the tax on tea but all the taxpayers too.

Through such devices as using economy cars or just staying home, this generation could reduce gasoline consumption so much that the lords of the squeeze stations would lose not only the tax on gasoline but the petroleum and automotive industries too.

—Henry D. Ralph

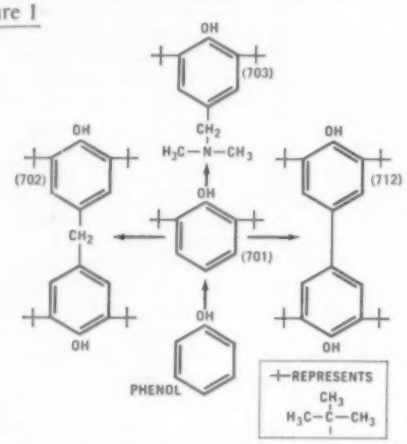
Discovery of "Ortho-Alkylation" reaction makes possible a new series of antioxidants for petroleum and petrochemical products

ETHYL'S DISCOVERY of the "ortho-alkylation" reaction has made available commercially, for the first time, a whole new series of phenol and aniline derivatives alkylated in the two and six positions.

All of these compounds are excellent chemical "building blocks" because of the open reactive para position on the benzene ring. (Figure 1)

Exhaustive evaluation has shown that many of these compounds have superior antioxidant characteristics in specific petroleum product applications.

Figure 1



Phenol and iso-butylene are combined by Ethyl's patented "ortho-alkylation" process to form 2,6-di-*tert*-butylphenol (701). This compound, with the open reactive para position, is a chemical "building block" for other important additives.

"Ethyl" Antioxidant 701— A Gasoline and Jet Fuel Additive

One of these compounds, 2,6-di-*tert*-butylphenol, is an excellent gasoline and jet fuel additive for inhibiting the formation of gum and other oxidation products. This compound is available commercially as "Ethyl" Antioxidant 701 and in a more economical form as "Ethyl" Antioxidant 733.

The importance of 2,6-di-*tert*-butylphenol is increased by the fact that its derivatives contain the hindered phenol structure which is characteristic of effective phenolic antioxidants. This led Ethyl Research in the direction of many possible additives.

701 Also an Intermediate to Other Additives

Early work showed that a highly effective structure pointed to a compound in which the two and six positions were occupied by *tert*-butyl groups. The four position was then used to test substituents in experiments designed to modify the 2,6-di-*tert*-butylphenol structure in order to obtain improved antioxidants.

"Ethyl" Antioxidant 702. A Lubricant Antioxidant and Anti-Wear Agent

Lubricant applications involve elevated temperatures and aeration and thus it was desirable to examine structures having minimum vapor pressures. This suggested compounds with higher molecular weights that still retained desirable antioxidant properties.

One important additive resulting from this work is 4,4'-Methylenebis (2,6-di-*tert*-butylphenol) ("Ethyl" Antioxidant 702), an exceptional lubricant antioxidant. It is a low volatility, non-sludging, temperature-stable, phenolic antioxidant and anti-wear agent.

Numerous laboratory and field tests were used in examining the characteristics of "Ethyl" Antioxidant 702:

Antioxidant Evaluations

ASTM Steam-Turbine Oil Tests • Panel Coking Tests • Automatic Transmission Tests • CRC L-4 Tests • Modified Polyveriform Tests • EMD Silver Corrosion Test

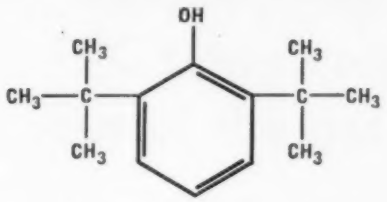
Anti-Wear Evaluations

CRC L-4 Tests • Chevrolet "Full-Throttle" Tests • "Hot-Ring" Tests • CRC FL-2 Tests

"Ethyl" Antioxidant 702 has found application in crankcase oils for gasoline and diesel engines. Both oxidation and bearing corrosion are inhibited (Figure 2) and scuffing-type piston ring wear is minimized.

The compound is finding increased use in railroad diesel engine oils and in other applications where copper, silver and bronze parts are critical. In all evaluations, oil treated with "Ethyl" Antioxidant 702 showed outstanding improvement.

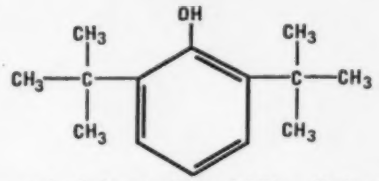
701—2,6-Di-*tert*-butylphenol



In motor and aviation gasoline to inhibit oxidation during storage; in jet fuels to inhibit oxidation during storage; and in industrial oils to inhibit oxidation.

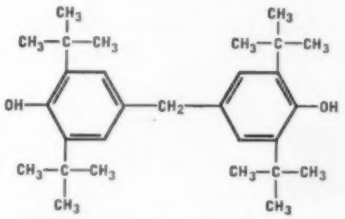
733—2,6-Di-*tert*-butylphenol (75% min) 2,4,6-Tri-*tert*-butylphenol (10-15%) Ortho-*tert*-butylphenol (10-15%)

(75% Min.)



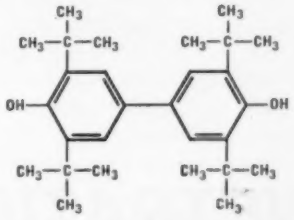
In motor and aviation gasoline to inhibit oxidation during storage; in jet fuels to inhibit oxidation during storage; and in industrial oils to inhibit oxidation.

702—4,4'- Methylenebis (2,6-di-*tert*-butylphenol)



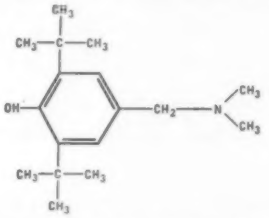
In motor oils for both gasoline and diesel engines to inhibit oxidation and minimize scuffing-type piston ring wear; in automotive transmission fluids and industrial oils to inhibit oxidation; and in plastics and rubbers to inhibit oxidation.

712—4,4'-Bis (2,6-di-*tert*-butylphenol)



In petroleum-based oils for high-output engines to inhibit oxidation and minimize scuffing-type piston ring wear; in diester-type synthetic oils to control oxidation and deposit formation; and in plastics and rubber to inhibit oxidation.

703—2,6-Di-*tert*-butyl-α-dimethylamino-p-cresol



In motor oils, greases and industrial oils to inhibit oxidation and impart alkylinity, dispersancy, anti-rust and anti-wear properties; in diester-type synthetic oils to inhibit oxidation during storage.

EMD SILVER CORROSION TEST

Silver coupons from railroad diesel engine oil test at 275°F. for 72 hours.

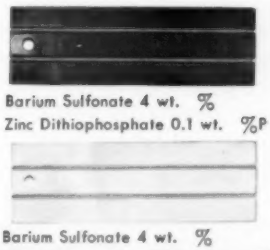


Figure 2

How Ethyl Research is helping you

Ethyl Research Laboratories are searching continuously for new and better additives for the petroleum industry.

The discovery of the "ortho-alkylation" reaction opened a new field of investigation. As a result, several excellent antioxidants are now available for a wide range of petroleum and petrochemical products.

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Welex, the originator of jet perforating, through the years has been the leader in the game of "follow the leader" in perforating by pioneering such developments as the Super Dyna-Jet, the Swing Jet, the Frac-Jet and many other field-tested methods of deeper-penetration perforating.

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FPC takes competition out of the gas business

ANOTHER big step toward bureaucratic control of the gas industry and the elimination of competition as a factor in setting prices of natural gas has been taken by the Federal Power Commission.

The commission apparently has moved toward two basic policies for the future: It will not permit the interstate movement of large quantities of gas primarily for use as boiler fuel; and it will not permit distributors or big industrial users to purchase gas directly from producers and have it transported by contract-carrier pipeline.

These policies may be within the scope of FPC's authority, but they certainly were not specifically directed by Congress. They look like an attempt to keep the nation's gas supply bottled up for those distributors now getting it at a low price, and to deny it to any who would pay more.

THIS IS A BLOW to expansion in the gas business. Much of the pipeline construction of the last few years has been made possible by the two things FPC is now undertaking to stop.

Proof that gas is ridiculously underpriced is the fact that big industrial users have been paying field prices double what distributors used to pay and still find it cheaper than coal or oil. Their bidding has been largely responsible for the increase in new-contract field prices.

These new high prices are still below the energy value of gas, but they are high enough to encourage exploration and production. They are also high enough to serve as a lever that could eventually raise all field prices—and that seems to be the cause of FPC's alarm.

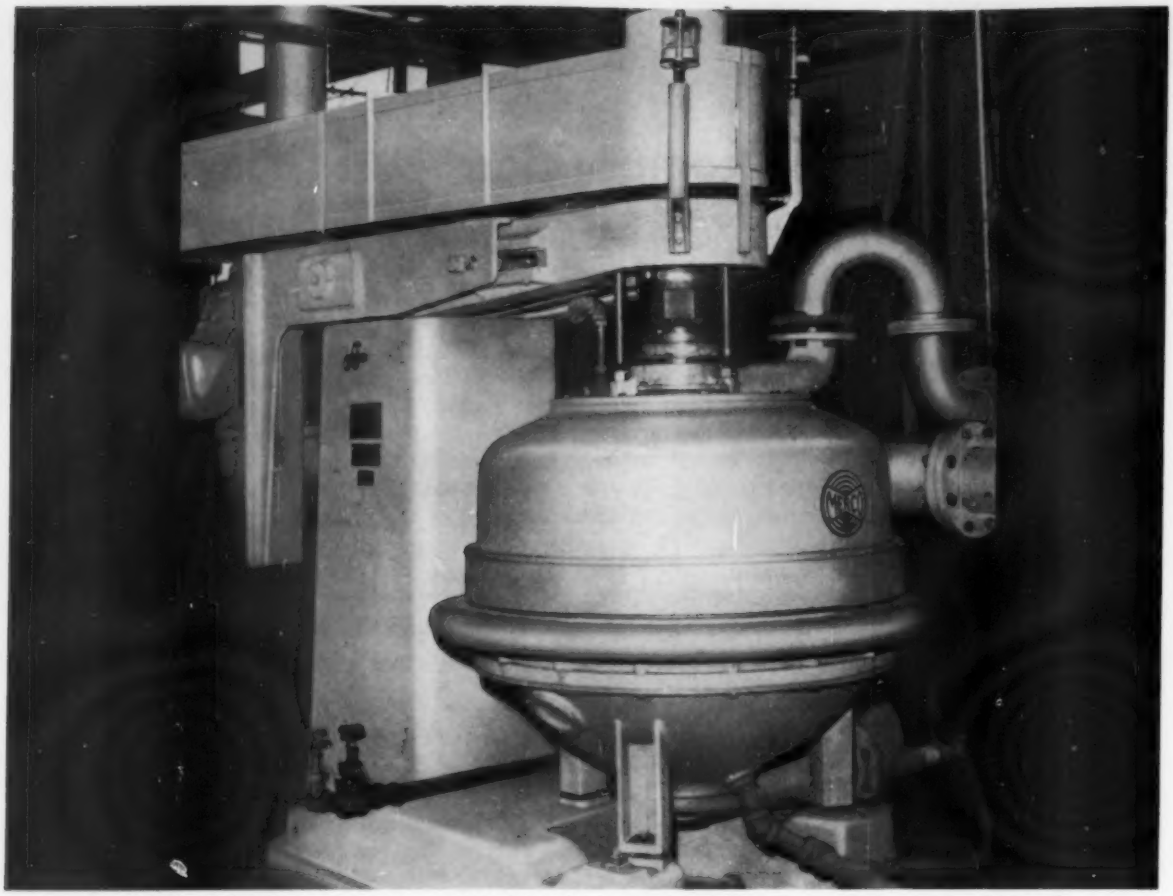
Some progressive distributors likewise have been negotiating new supply contracts directly with producers, thus eliminating the pipeline as a middleman and avoiding some FPC regulation. This was a good deal for both buyer and seller, and also for the pipeline which makes its money from transportation and is relieved of the buying function.

Who suffers from such transactions? Just one group of interests: Local gas distributors who fear that these new markets and new methods will upset their little red wagon. They want to continue to have increasing quantities of gas brought to their city gate at the same old low prices, without any need to locate or bargain for new supplies, and without any new kinds of buyers competing for the supply.

BY SPECIOUS REASONING, the Power Commissioners apparently have swallowed their staff's party line that the nation's gas belongs to a few favored customers at prewar price scales, and that new buyers willing to pay more must be kept out of the market.

This is tantamount to an outright government subsidy, with gas producers footing the expense.

But unless some degree of competitiveness is permitted in gas pricing there will be little new gas to haggle over within a few years.



New H-30 Merco Centrifuge, with increased speed and capacity, in operation at Argo, Ill. plant of Corn Products Refining Co.

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increased capacity in NEW MERCO CENTRIFUGE for nozzle bowl applications

Rotor speeds up to 3300 rpm and capacities up to 600 gpm are now possible with the new, improved H-30 Merco Centrifuge. At the same time, power requirements per gallon of feed have been substantially reduced.

This new operating efficiency is a result of improvements in rotor design, which provides greater disc area. Feed passages have been enlarged to accommodate increased flow.

The new Merco H-30 Centrifuge is particularly useful for clarification and thickening of slurries which contain fine solids (0.5 micron) over a wide range of feed solids concentrations (.02% and up). It is now available with a 30" stainless steel rotor and bronze or stainless steel housing. In addition to its new large capacity and higher speeds, it contains such well established Merco features as the return flow principle, clog-free nozzle and hydraulic hoist for every inspection and maintenance.

If yours is a process that needs a large capacity centrifuge, there is a place for the Merco H-30 in your plant. Write to Dorr-Oliver Incorporated, Stamford, Connecticut.

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the OIL AND GAS JOURNAL

ANOTHER TRAIN of finished steel heads from the mill to the oil industry. Sales of line pipe like this for gas transmission lines have picked up, but the big scramble is for tubular goods. Fear of a steel strike this summer finds . . .

Oil Buying Heavily From Supply Men

● "We'll do all our business in the first half," says one tubular-goods man. There's plenty available, but the big firms are taking no chances. They want their entire '59 supply guaranteed, so they're buying it now and storing it.

THE OIL INDUSTRY suddenly has started buying steel.

Supply men who were getting only conversation from company purchasing agents in December now are writing plenty of firm business in their order books for tubular goods.

Most of the business is for full second-quarter orders. Some, however, covers third and fourth-quarter needs. Prospects are the trend will continue brisk for a few more months, then drop sharply after midyear.

Buyer for one major integrated oil company frankly told the Journal:

"We're buying steel now for our needs through the third quarter for all items, especially casing, tubing, line pipe, and gate valves.

"We'll have all the items paid for, delivered, and stocked in our warehouses by June 30."

His company's buying policy apparently shows the pattern in the oil industry: Buy for needs through the third quarter and get it delivered by the end of second quarter.

What's happening . . . Explanation for the sudden buying spurt is simple:

. . . Inventories of steel items in hands of oil companies have been cut to the bone.

. . . Steel strike in midyear could shut off supplies of tubular goods temporarily and hamper drilling programs.

Most of the major companies thus are rebuilding inventories and hedging against a steel strike. Their inventories were slashed drastically by late 1957 and 1958 economy moves. So they now are building back inventories slightly above current needs to protect their budgeted programs.

Extent of the inventory reduction is revealed by the experience of one major. In 1956 this company purchased nearly 22,000 tons of steel. Under 1958's economy program, it purchased only 2,100 tons.

Preliminary steel industry estimates indicate the oil industry in 1958 cut its orders for oil-country goods by more than 36%, and for all steel items by 52%. During the first 8 months of last year, all consumers reduced stocks by 6 million tons.

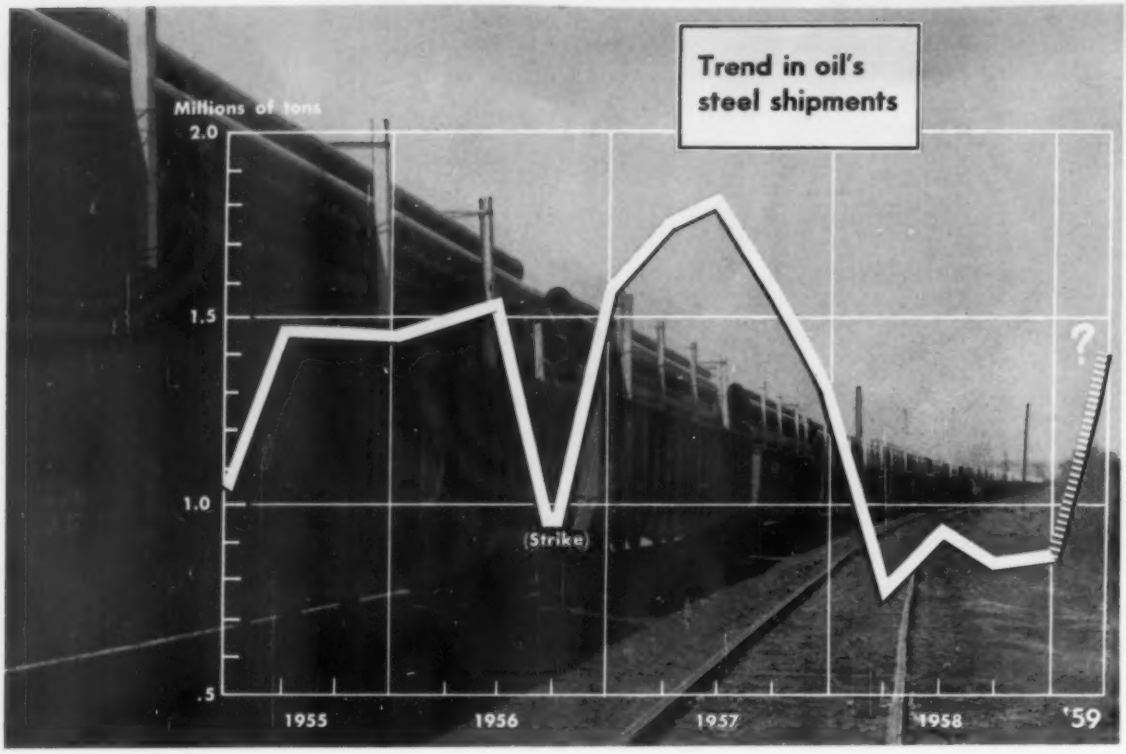
Behind this inventory whacking was the knowledge that the steel industry had plenty of capacity and that barge terminals and supply centers near the oil country had been set up to assure nearly overnight delivery. The need for carrying heavy and expensive inventories appeared over.

Why the switch? . . . The steel-producing capacity and new distributing centers still exist.

But one oil-company purchasing executive explained his company's inventory policy switch like this:

"We talked to executives of mills, suppliers, and fabricators early last month. Fabricators of nearly all steel items used by the oil industry reported they were buying steel stocks heavily, as insurance against interruption of deliveries by any possible strike.

"Mills and suppliers also reported



a heavy trend in steel buying from other industries.

"It just appeared to us that steel might be tight by midyear and we also should protect ourselves. We acted quickly and filled our needs through the third quarter. We're not buying items we won't need this year. We're only being certain we have supplies when we need them."

This company also is taking quick deliveries to avoid any transportation jams. Some 40% of its steel orders will be delivered in March, another 40% in April and the balance covering the third quarter will be shipped to its warehouses in May.

The steel industry also is encouraging movement now of orders away from its warehouses to avoid later jams. One buyer reported a big mill offered to ship steel now and finance payment, guaranteeing against a price increase until October.

Another, however, is offering to carry orders in its own storage until the third quarter. In fact, a variety of deals still appear open to steel buyers, and supplies at the moment are not tight.

Who's buying . . . The buying increase is being paced by the large users. But not all of them are following the trend.

At least one major, with an extensive domestic drilling program budgeted, is still following a 30-day buying policy.

The buyer for this company reported his management has ordered inventories kept in balance with usage at the time when other companies were cutting inventories drastically. The result is no unusual amount of current buying. Purchases are up some, this buyer admitted, but so is his company's need for steel.

Another major buyer reports he has heard of several companies placing large tonnage orders, some through the third quarter and at least one for the full year.

"You can get what you want now," he says. "The market still appears loose. But at least the larger companies are not relying on ability of suppliers to care for them with quick deliveries."

Here's the way the purchasing agent for another major sees the tubular-goods situation:

"At the rate we're going now, there'll be no pipe-buying business the last half of the year. But this happens year after year. One company decides to shoot in a big order. The word gets around; and others, regardless of information they have, decide something is up, and they start stocking up too.

"The industry is becoming more and more concerned about the possibility of a steel strike. When March rolls around, I expect the orders really will be rolling in. Even if there is no strike, we'll still be paying more for pipe because there probably will be a wage increase."

How suppliers see it . . . Steel men naturally welcome the rush of business, but frankly they don't like the "feast and famine" aspect of the orders.

One commented wryly: "We'll do all our business in the first half and sit on our hands the rest of the year."

Some supply people are advising their big customers to go easy on orders. They fear a big rush of business will create a false shortage, jam supply channels, and cause the supply industry to be unable to serve all its customers, especially the smaller buyers.

The sales manager for one of the large mills reports "we are telling our customers to use a little sense in buying.

"There's no reason for an acute shortage," he says. "We can fill all the needs of our customers if they buy orderly and in line with their budgeted programs."

Another supplier indicated the steel industry may be considering taking some measures to prevent steel hoarding or stockpiling up to the hilt. He admitted this may be a forlorn hope, that about all the suppliers can do is

encourage buyers to take quicker deliveries.

"We're in a selling business, and we don't alienate those who make our bread and butter for us," he commented. "We're advising our customers not to buy anything they don't need. But a company with any kind of drilling or expansion program needing steel isn't going to rely on someone else for vital supplies. It will establish its own protective devices."

The smaller oil operators are concerned by the spurt in tubular-goods buying, but are not building up inventories at present. One supply house says its executives have been asked by their independent customers to protect them against a tight steel market.

"We feel certain there's nothing in sight now to indicate a critical shortage will occur. We are assuring our smaller customers we'll have the steel goods when they need them to drill a well," this supplier said. He emphasized the current buying involves tubular goods. The oil industry is buying other items more closely in line with actual needs.

The steel industry itself foresaw an increased inventory buying, but the sudden strength of purchases has caught it off guard. Last week steel buying over the U. S. generally hit the fastest pace in more than 2 years. The rush already is extending some delivery dates and causing some long-idle furnaces to be refired.

Production in the first quarter is now expected to hit nearly 85% of capacity, now estimated at 147 million tons annually. Only a few weeks ago steel men thought they would do well to get business equaling 75% of capacity.

Strike outlook . . . Unionized steel workers are certain to press for wage increases in June and insist on concessions that will result in an increase in steel prices.

One source suggests goal of steel unions may be a 40-cent hourly raise.

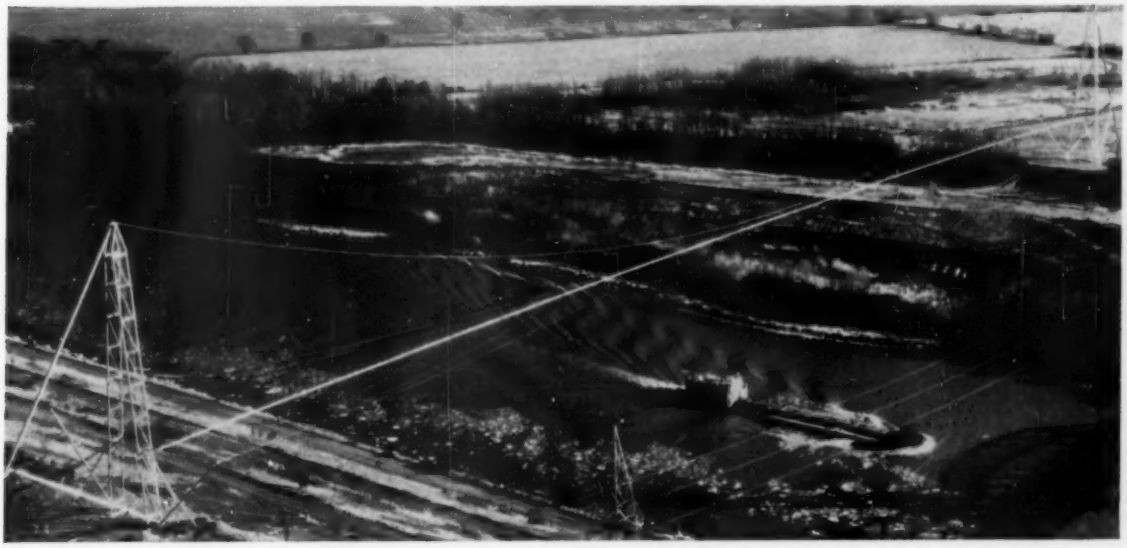
Steel management at this early date appears laying the ground work for resistance to any increases that would push up prices. In the last 8 years steel wages have gone up $1.25 an hour or 76%, and steel prices have been advanced $47 a ton or 61%. In the last 3 years alone, steel wages have increased 73 cents an hour including fringe benefits and escalations and steel prices by $20.26 a ton.

This wage-price spiral naturally is unpopular with steel customers. The steel industry already has bought newspaper advertising months prior to its mid-May negotiations with the unions, trying to win public support for its theme that the wage-price spiral robs everyone.

The steel-industry advertisements also answer labor-sponsored advertisements which proclaim the economic boost from increased wages in steel communities.

The current rush of business may put the steel industry in a better bargaining position. A good part of the year's business will be done by July—the industry thus could weather a strike better than usually.

Whether a steel strike will develop is anyone's guess. But it's enough of a threat to call the tune on the oil industry's steel-buying practices.



Pipeline Bridge Built Across Canal in One Day

NEW DESIGN and erection procedures enabled Eastern Shore Natural Gas Co. to span the Chesapeake & Delaware Canal with a 1,304-ft., 12-in. pipeline bridge while halting traffic only 24 hours.

Midwestern Contractors, Inc., built the bridge. Its design features pivoted towers which were hoisted erect, pulling the cable system and line pipe aloft. Another feature is the extensive use of wire rope—13,648 ft. fabricated by Bethlehem Steel Co.—for bracing. Clear Span Engineering Co. designed the cable and tower assembly. The three-legged towers, fabricated by Trinity Steel Co., were assembled with two legs attached to foundations. On one side of the canal the pipe was attached to the main 2⅞-in. rope strand by 63 suspenders of ½-in. bridge rope. The suspenders ranged in length from 3 to 113 ft.

A trolley cable 1½-in. in diameter carried the weight of the pipe and supporting strand assembly as it was pulled across by winches. Then the towers were pulled upright.

The cable and tower assembly was designed to support a dead weight of 250 tons during erection and 64 tons permanently. The bridge spans the canal at a height of 141 ft.

Small-Tract Well Upheld

. . . by Texas court. Drilling permit for 1/5-acre lease in Normanna field called valid, but second suit is pending.

THE LATEST direct attack on small-tract drilling in Texas crumbled last week like others before it.

Judge Charles O. Betts in district court in Austin upheld the validity of a drilling permit issued by the Texas Railroad Commission to Bright & Schiff, Dallas independent operator, for a well on a 1/5-acre tract in Normanna gas field, Bee County (OGJ, Jan 12, p. 50).

The judge did so by dismissing a suit filed by Atlantic Refining Co., Tidewater Oil Co., and other operators in the field to nullify the permit.

The suit was a frontal attack on Texas' controversial Rule 37 exception to spacing rules under which an operator is permitted to drill at least one well on his acreage under certain conditions, no matter how small the tract.

Betts agreed with the Dallas independent that it was entitled to the permit as a matter of law and that the case should be dismissed due to lack of a sufficient cause for legal action.

Atlantic and Tidewater argued that Bright & Schiff lease is too small to qualify as a valuable property right—that, since gas in place under the lease could not pay for the well, Bright & Schiff isn't entitled to drill.

They said the Dallas independent had been offered equitable terms either to join a drilling unit or to sell its tract to the other operators but had refused these terms. If allowed to complete the well, Bright & Schiff would drain great quantities of gas from under adjoining leases owned by plaintiffs, they said.

Flank attack on . . . Whether Atlantic and Tidewater will carry the Rule 37 battle higher in the courts through further appeals is not yet known.

It may be that they will switch their legal guns to concentrate solely on doing indirectly what they have so far failed to do with a direct assault.

At the same time Atlantic and Tidewater filed the Rule 37 suit they also filed a companion suit seeking to upset the Normanna field proration order.

This suit, filed in the same court in Austin, in effect attacks the commission's conventional practice of basing allowables in gas fields with such small-tract wells on a two-thirds acreage, one-third well formula.

Normanna field has this allocation formula.

Atlantic and Tidewater in the companion suit seek a formula based 100% on acreage or one restricting the well factor to not more than 5%.

Atlantic engineers estimate that only $15,000 worth of minerals underlay the Bright & Schiff lease. The Dallas independent will spend $160,000 to drill its well. The present allocation formula will permit it, they argue, to produce roughly $1,500,000 worth of gas—all but $15,000 worth of it being drained from under adjoining leases of the plaintiffs.

Bright & Schiff admits there will be drainage but contends that Atlantic estimates are "grossly exaggerated." The well would produce at the most some $300,000 worth of gas, the Dallas operator said.

Both Bright & Schiff and the Railroad Commission defend the Normanna allocation formula as consistent with past and present proration practice in Texas. Commission regulations and past court decisions all, they say, uphold its right to drill a well and recover expenses plus a reasonable profit even if drainage results.

The suit to upset the Normanna allocation formula was originally set for February 9. It was postponed last week by Judge Betts to February 24, at plaintiff's request.

If Atlantic and Tidewater should win this suit and the decision stand, the effect would be to discourage small-tract drilling in the state by making it uneconomic.

A well drilled on a few acres or a fraction of an acre would be a losing proposition with allowables based on straight acreage.

Another blow . . . Besides the Rule 37

Refinery Strikes Nick 5% Off the Nation's

• Both shutdowns involve craft issue. A total of 7,100 employes of Gulf and Shell plants are also idled.

TWO REFINERY strikes have made a small dent in the nation's refining capacity, shaving 460,000 bbl. off a total of 9,130,000 bbl. daily.

The shutdowns also have halted paychecks to about 4,600 employes at Gulf Oil Corp.'s 285,000-bbl. Port Arthur, Tex., refinery, and about 2,500 workers at Shell Oil Co.'s 175,000-bbl. plant at Wood River, Ill.

The two strikes are similar in that both involve job classification issues rather than amount of wage increases. Both Gulf and Shell have offered a 5% wage hike which has become the accepted pattern throughout the industry (OGJ, Jan. 26, p. 97).

The Port Arthur refinery was shut down January 28 by a locally called strike of the Oil, Chemical and Atomic Workers Union.

The Wood River plant, one of the largest in the Great Lakes area, was closed two days later by a strike called by 11 craft unions representing various refinery workers.

Gulf strike . . . Gulf charges the strike is a dispute over "featherbedding" and that Gulf will not back down.

The union, agreeing to the 5% wage boost, balked at a company-proposed contract provision that employes could perform minor tasks outside their normal job classifications when necessary to complete their assigned work.

Gulf wants to eliminate the necessity of calling in a skilled worker to disconnect a piece of pipe, mark a bin, start a compressor, or do a similar simple task. The company listed about 50 illustrations where a worker in one classification could do an unskilled job normally performed by another.

Gulf explained that it does not contemplate establishing a work classification of "refinery mechanic," nor is it attempting to abolish craft lines.

J. Elro Brown, District 4 representative for OCAW, denied that featherbedding is practiced at the Port Arthur refinery. He said Gulf, in asking for the reclassification clause, wants "unilateral right to change classification day by day without regard to the union."

Proration . . . Gulf strike brought quick proration in crude purchasing by the big refiner. The cutback came in Texas, New Mexico, and Alabama.

Before the strike, Gulf was taking approximately 275,000 bbl. of crude daily for the Port Arthur plant.

Under proration, buying will be re-

defeat, Atlantic and Tidewater suffered still another legal rebuff last week in the Normanna fracas—this one from the Civil Court of Appeals in San Antonio.

The appeals court affirmed an injunction issued by the Bee County district court restraining Atlantic and others from unlawfully interfering with efforts by Bright & Schiff to drill its well.

At the same time, it upheld the district court's denial of an Atlantic et al. request for an injunction restraining Bright & Schiff from using in its drilling operation land adjoining its lease on which it had obtained surface rights. The adjoining land at issue was part of a block on which Atlantic owned mineral rights. Atlantic contended that the landowner could not lease surface rights on land where this would injure the mineral-rights owner on that land.

The land at issue was needed by the Dallas independent to get enough room to conduct its drilling operation.

Bright & Schiff accused Atlantic, Tidewater, and Dudley T. Dougherty of first interfering unlawfully in its efforts to engage a drilling contractor. Later, it said, these firms unlawfully denied it the use of the adjoining surface lease by first attempting to build a warehouse on the land, then a tool house, and finally by starting to drill a water well.

The district court decision found the Atlantic et al. blocking methods unlawful and enjoined them from such further interference.

Total Capacity

duced by approximately 121,000 bbl. daily.

Gulf will prorate sour crude on a 4-day buying pattern in Texas and by the same percentage in New Mexico. Texas has an 11-day allowable this month. Alabama buying also will be cut by the same percentage. Proration of Ellenburger crude will be on a 6-day pattern.

Shell strike . . . Officials at the Wood River plant also were standing pat on the job classification issue.

P. J. Merkus, plant manager, said the company " . . . will not accept provisions that would result in featherbedding, late, and wasteful practices."

Another Shell spokesman was quoted as saying, "We are perfectly willing to generally recognize jurisdictional lines, but there must be some latitude as far as practicability is concerned."

watching WASHINGTON

Joe Reilly

• Antitrust wants 20 more lawyers

THE DEPARTMENT OF JUSTICE will step up its antitrust activities if it can get more money from Congress.

Having evaded the President's economy axe, the department's antitrust division hopes to get a budget increase of nearly 10% for the fiscal year starting July 1. The President's budget calls for $4,175,000. That compares with $3,800,000 appropriated for this year.

If Congress approves the increase, Asst. Atty. Gen. Victor R. Hansen plans to hire about 20 more lawyers for his antitrust division.

Critics of the Eisenhower administration have accused it of being friendly to big business. Hansen is trying hard to absolve Ike of such a grievous charge. He points out that nearly twice as many antitrust cases were filed last year as during a comparable period under Truman.

Hansen has mapped an aggressive drive "in those areas of the economy which most significantly influence the cost of living." By vigorous prosecution, he hopes to aid the administration's fight against rising prices.

Some of the major antitrust cases now pending involve the petroleum industry. Twenty-nine major oil producers face trial in Tulsa for alleged price fixing. Three natural-gas companies and their presidents are under indictment in Milwaukee on a conspiracy charge. Antitrust action has been filed against Standard Oil Co. (N.J.) and Standard Oil Co. (Ky.) in Louisville. In Salt Lake City, an antimerger suit is hanging over El Paso Natural Gas Co. and Pacific Northwest Pipeline Corp.

The stepped-up antitrust drive envisioned by Hansen would cost taxpayers an extra $375,000 the first year. It might cost oil and gas companies that much more to defend themselves against additional charges.

• New study may mean mandatory controls

THE SWITCH IN SIGNALS by the cabinet fuels committee is a strong indication that mandatory controls will be adopted to curb oil imports.

If the presidential advisory committee planned merely a new system of voluntary controls, there would be no need for another study of imported oil's effect on our national security.

The Justice Department is understood to have insisted on the new study by the Office of Civil and Defense Mobilization. A mandatory control program would be subject to court test, and a suit already is being prepared by one of the companies which refused to conform with the voluntary program.

The Trade Agreements Extension Act gives the President power to restrict oil imports if they are found to be excessive and constitute a security threat. Crude-oil imports qualified for controls under a "certification" nearly 2 years ago by Gordon Gray, then director of the Office of Defense Mobilization. By implication, petroleum products were later brought under the same ruling.

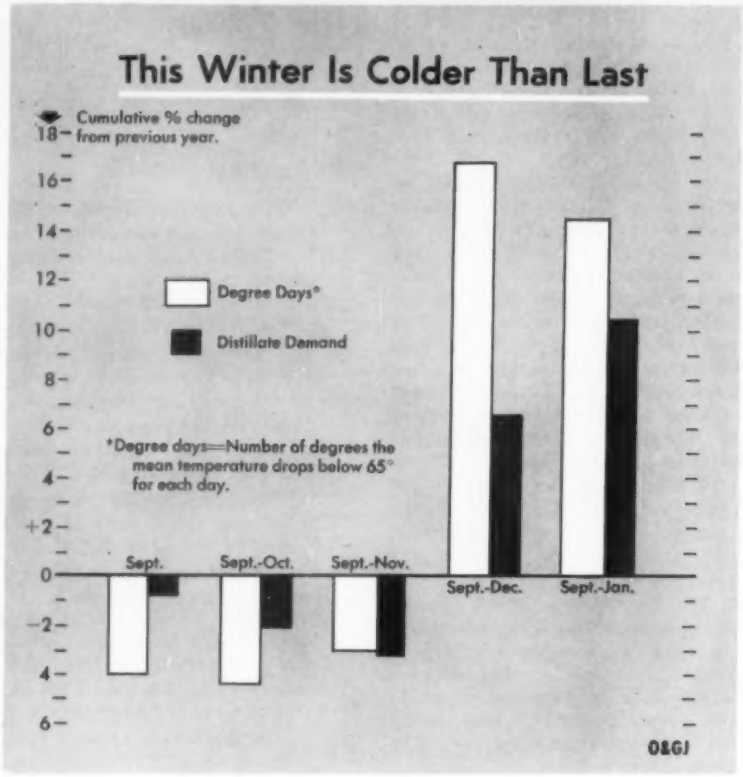
The question arose whether the 1957 finding still applied. There also was some doubt whether products had been properly certified as a security threat. The new investigation should clear up such objections. It also could give mandatory controls a better chance to survive in court.

A majority of the cabinet committee is believed to have agreed on mandatory controls to start March 1. They had been discussed many times in the past, but each time the committee backed off rather than subject the oil industry to such regimentation.

It's conceivable that the new study by a new official might find oil imports are not a great enough threat to warrant mandatory controls. The whole imports program is in jeopardy if such a possibility is considered. Otherwise, if the decision already has been reached, the present study is mere window dressing.

As Oil Warms a Cold U.S., Big Demand

- **Refiners shifting yields to produce more distillates as prices follow demand up.**
- **Gasoline prices are firming up as result of the cold weather and strikes.**



CONTINUED cold weather is proving a blessing—and a headache—to a big portion of the nation's refiners and marketers.

It has put a tremendous kick in the demand for heating oils.

The result is that fuel oil and middle distillates are in tight supply in the Mid-Continent, Gulf and East coasts, and prices are improved.

The gasoline market is strengthening slightly as a corollary result and also due to strikes at Gulf's Port Arthur refinery and Shell's Wood River, Ill., plant (see p. 64).

Prices have followed the demand upward.

Current prices of distillate are more than a cent a gallon higher in the larger wholesale markets in the East. Present New York tankwagon price of 15.1 cents a gallon is up 1.3 cents over last February. The Chicago price of 15.1 cents is up 0.5 cent a gallon over last year.

On the Gulf Coast and in the Mid-Continent, distillate prices moved up one-fourth cent within the last 2 weeks and have firmed there. No. 2 is bringing 10 cents a gallon in the Mid-Continent area and 9.825 cents on the gulf.

Drain on stocks . . . Supplies are becoming extremely tight in both areas and are now aggravated by strikes.

Shell's plant took about 40,000 bbl. daily of distillates out of production. Another 500,000 bbl. weekly is lost through the Gulf strike.

Officials of three independent refiners on the gulf have reported they are sold out of distillate through February.

One said the cold weather was causing the short supply and added that the Gulf strike has served to tighten up the situation. As for the higher prices, he observed: "Personally, I don't question where they came from. I just accept them. We don't quite have prosperity, but we have a lesser amount of austerity."

Another refiner called the better prices a godsend "because we weren't getting enough for our products before."

Gulf Coast refiners have stepped up their projected runs of middle distillates, principally No. 2, by 20% during the last 2 months. This will continue at least through February.

Official of one major refinery said "if the cold weather in the Midwest, East, and South Atlantic continues, there could be a shortage of heating oil where people could be getting cold. But it's not that bad yet."

Reports are current on the gulf that a number of buyers are taking unwanted gasoline in order to get shipments of heating oil. The practice isn't widespread yet but often occurs in a tight market.

As for tankers to move products east, no shortage of ships has developed on the gulf yet. Tanker rates, however, have risen sharply in the past month. Rates today are 20% above USMC for clean vessels and 25% for dirty. This compares with 10% above USMC for both categories a month ago.

How cold is it? . . . Weather in the U.S. for the 5 months ending in January has been 14.4% colder than for the same period last year and 4.4% colder than normal.

This information is the result of a special study made by Ted Gilbert, New York economist for Shell.

Gilbert reports that degree days for the 5 months have averaged 3,347 in the U.S. as a whole on a weighted basis. This is 421 degree days more than for the same period last winter, and 141 degree days above normal.

(Degree days are figured from September through May on a cumulative basis. A degree day is added for each degree below 65° that the mean temperature of a 24-hour period averages.)

December was especially cold. Gilbert's data shows the month had 1,178 degree days compared with 835 last year and a normal of 1,023. The weather in New York, an important fuel center, was the coldest for December since 1926 and the coldest for a 5-month period since 1947.

Effect on demand . . . It takes no imagination to know that cold weather will help demand for heating oil.

But the oil industry correlates demand very closely to degree days. It's estimated that the industry sells about 110,000 bbl. of heating oil for each degree day in the U.S. This breaks

Tightens Fuel Supply

A 3-Year Look at Winter Months

(In Degree Days)

	Sept.	Oct.	Nov.	Dec.	Jan.	Total Sept.-Jan.
1958-59						
Districts 1 and 3	62	341	520	1,132	1,075	**3,130**
District 2	84	315	723	1,364	1,454	**3,940**
East of Rockies	69	333	588	1,209	1,201	**3,400**
West Coast	135	263	610	591	743	**2,342**
U. S.	72	330	589	1,178	1,178	**3,347**
1957-58						
Districts 1 and 3	52	293	496	757	1,030	**2,628**
District 2	123	437	807	1,018	1,213	**3,598**
East of Rockies	76	342	600	845	1,091	**2,954**
West Coast	59	402	631	650	656	**2,398**
U. S.	75	345	602	835	1,069	**2,926**
1956-57						
Districts 1 and 3	138	273	553	812	1,194	**2,970**
District 2	131	189	785	1,023	1,467	**3,595**
East of Rockies	136	245	630	882	1,285	**3,178**
West Coast	164	440	662	753	1,018	**3,037**
U. S.	137	255	632	876	1,272	**3,172**
Normal						
Districts 1 and 3	58	289	590	953	1,054	**2,944**
District 2	109	372	810	1,204	1,309	**3,804**
East of Rockies	75	317	663	1,036	1,139	**3,230**
West Coast	154	365	609	765	859	**2,752**
U. S.	79	319	660	1,023	1,125	**3,206**

down to 75,000 bbl. of distillate, 17,000 bbl. of kerosine, and 18,000 bbl. of residual fuel.

Since September, domestic demand for kerosine and distillate has gained 8% over the same period last year. This amounts to a gain of 190,000 bbl. daily or a total of 30,000,000 bbl. The remarkable aspect of this gain is that it occurred in December and January, because the earlier months were warmer than normal and demand trailed last year's figures.

December, for example, registered a demand gain of 25% and January 17% over the same months a year ago. The earlier months registered demand losses.

Largely because of the cold weather, total domestic demand for all oils was up nearly 1,000,000 bbl. daily in December and January. Of this 600,000 bbl. daily was in the intermediate category. All of this was due to the weather except about a 50,000-bbl. daily gain in diesel usage and 75,000 bbl. daily attributed to installation of new burners since last year.

Residual demand also increased about 50,000 bbl. daily during the period due to shutoffs of natural gas supplies which resulted in a larger call on residual than degree days would indicate.

Inventory picture . . . Weather, naturally, has a pronounced effect on fuel-oil inventories.

Refinery runs and intermediate yields usually are expanded if weather is colder than normal and reduced if weather is warm. But still the large swings in demand due to sharp changes in degree days must be met in large measure out of existing inventories.

The extreme cold weather in December and January resulted in stock declines of 76 million barrels for the 2 months. This is the largest decline for any 2-month period on record.

The industry started November 1 with 197 million barrels of intermediates on hand. By the end of January this had dropped 80 million barrels. While inventories in November were 14 million barrels less than the year before and 2.3 million barrels more than 2 years ago, by January they had fallen 28 million barrels below the 1957 level and 8 million below the 1956 mark. The drop occurred despite an increase in refinery runs and yields for the period.

Prices . . . The sudden increase in kerosine and distillate demand in December started prices moving up from the depressed levels that prevailed during the summer.

Gilbert's study shows that No. 2 fuel prices currently are higher than a year ago. They were below normal then, however, because of a heavy inventory position and warm weather up to February 1.

Gilbert noted one interesting aspect: Timing of the cold weather is important on pricing. Cold weather has a more pronounced effect on prices if it occurs early in the season.

In other words, if weather is warm in the fourth quarter and then turns cold in the first quarter, it may not move prices up appreciably. But if the reverse is true, as it is this season, prices are affected.

Gilbert illustrates the point by comparing price activity between this season and last. December this year was 15% colder than normal for the U. S. as a whole and January 5% colder. Prices were affected greater than last season when extremely cold weather in February did not begin to offset the number of low degree days experienced earlier in the winter.

Demand outlook . . . The cold weather already has assured good first quarter demand for the domestic industry even if February and March weather is normal.

Gilbert estimates domestic demand for all oils should be 10,350,000 bbl. daily for the first quarter. This will include demand of 3,275,000 bbl. daily of intermediates. This represents a gain over the first quarter of 1958 of 623,000 bbl. daily or 6.4%. Gain for intermediates will be 235,000 bbl. daily or 7.7%.

The oil industry has met this surge in fuel demand caused by cold weather with no hardship to the public.

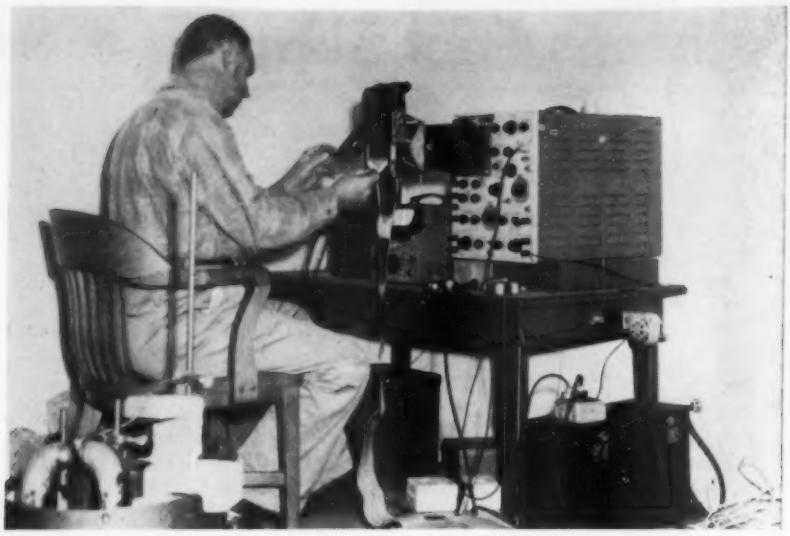
For the individual home owner the increased demand may seem insignificant—a hundred or so more gallons of fuel on a local truck delivery.

Gilbert pointed out few people realize the oil industry to meet these ups and downs in demand must stock 200,000,000 bbl. of kerosine and distillates by November 1 plus 40,000,000 bbl. of residual fuel.

This requires an investment of $1 billion in inventories at wholesale prices. In addition, steel tankage to hold the inventory requires a minimum capital investment of $35 million.

Without these inventories, only 3 out of 4 customers could be served during peak winter demand periods. The industry must use one barrel out of storage for every four used during this period.

DRILLING purrs along at corner of Western and Venice Blvd.



EXTRA MAN in the operation is Dr. Orville Polly, acoustical engineer who keeps tab on sound devices and can shut down drilling if it gets noisy.

Union Oil Drills While Los

• An acoustical engineer keeps a close eye on this city rig to make sure it doesn't develop the shakes and never is caught with its noise up. So far, things are lovely.

AN APARTMENT dweller walked across the street last week in Los Angeles and asked a Union Oil Co. drilling superintendent:

"When are you going to start drilling?"

At that moment, the bit was grinding away below 5,500 ft.

That was proof enough to Union that its effort to soundproof its downtown drilling project was a real success. Its biggest job now: Find oil.

Whipping the noise problem was no accident. Union planned it that way. It's a costly operation, calling for a lot of expensive equipment and requiring an extra man on the job. That's Dr. Orville L. Polly, Union's acoustical engineer.

Dr. Polly keeps tabs on a number of devices, checking vibration, sound, and strain levels. He has the final say so on practically every phase of operations, with authority to shut down drilling if things get too noisy.

Preparations and precautions taken —at a cost of about $100,000—have prompted city officials to describe it as "the quietest, safest, and most attractive" drill site in Los Angeles.

The rig is on a corner of a shopping center parking lot surrounded by a score of two-story apartment houses.

Contractor on the well is Santa Fe Drilling Co., which on its best day made 1,180 ft. of hole. Santa Fe is using 5⅞-in. drill pipe and 8⅝-in. drill collars.

Standards established . . . Union sound engineers conducted noise-level tests in the neighborhood almost 2 years ago to set up standards for the day when drilling actually would begin.

Elaborate sound, vibration, and strain-detection equipment was installed in a rented apartment adjacent to the drill site. The maze of electronic gadgetry includes:

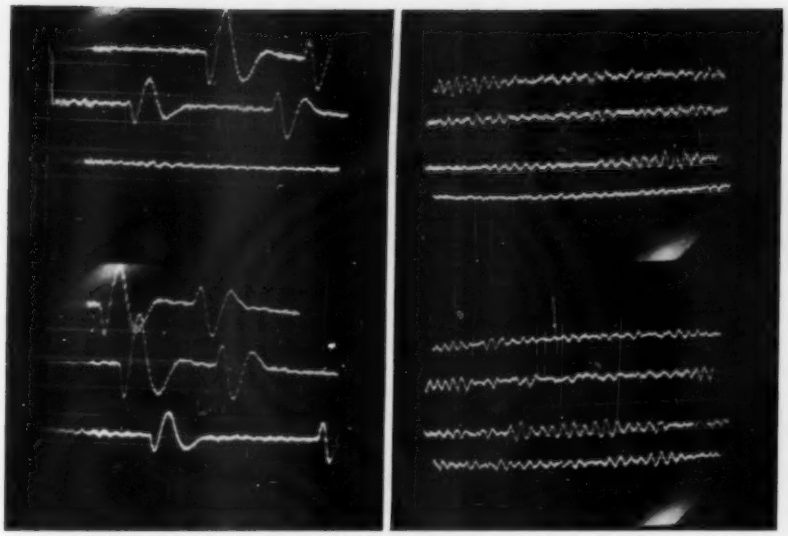
. . . A seismograph to measure vibrations. It is located in the center of the apartment building, about 150 ft. from the rig floor. A polaroid camera fitted to an oscilloscope records vibration levels at selected intervals.

. . . A spectrum analyzer and a tape recorder to study and record airborne noises.

. . . A strain gage attached to the plaster ceiling of the apartment.

. . . A field survey meter for measuring sound pressure levels and for interpreting loudness. This device is installed in a window overlooking the drill site.

These devices not only are used by the acoustical engineer for spot checks,



SUCCESS is shown by contrast in vibrations of start of an apartment refrigerator (left polaroid photo) and drilling operation (right).

Angeles Neighbors Sleep

but also provide a constant record to be kept on file. These could be used in event of lawsuits over alleged property damage or complaints of disturbing the peace.

Is it worth it? . . . The attraction for the expensive operation is that it's about the last undrilled topographic high in the Los Angeles Basin.

The well, No. 1 U-19, is being drilled on a 159-acre drilling district by Union, Signal Oil & Gas Corp., and Texam Oil Corp. in a joint operation. The three companies have about 2,000 acres under lease in the town-lot play near the intersections of Western and Venice Blvd.

Union engineers say the drill site can accommodate about a dozen wells.

Costly operation . . . This type of drilling is three to six times as expensive as wildcatting in undeveloped areas of California.

The usual price tag for a medium-depth well drilled in compliance with stiff city regulations runs from $250,000 to $500,000.

Before operations on No. 1 U-19 could start, the city required Union to lower the ½-acre drill site 3 ft. to conform to surface restrictions. This required removing existing blacktop, bulldozing out the site, hauling away the dirt, and then resurfacing with blacktop.

The site then was enclosed with an 11-ft. cement-block fence. The two corrugated iron sliding doors were sprayed on both sides with an expanded pearlite mastic for sound deadening.

The derrick, mud pumps, and generator buildings are enclosed with a multilayered soundproofing "blanket" installed on the structure in panels.

The panels consist of a 2-in. fiberglass matting, 2 by 6-in. board studs, a corrugated-iron siding sprayed with a fire retardent and acoustical mastic, a glass cloth, a layer of fiber glass, and then another glass cloth. Also, much of the equipment on the derrick floor inside the blanketed rig is covered with soundproofing material.

Above the first derrick girt 2 by 4 studding is used instead of the 2 by 6's used near ground level.

The upper part of the 136-ft. derrick has a false works giving it the appearance of a monument. This was to meet city requirements. Also, the derrick blanket was painted several shades to blend in with background colors. Initial installation cost of the blanket was $10,000.

All drilling is done with electricity which is converted from a.c. to d.c. at the drill site. The electricity bill runs about $70 a day.

The tool pusher must anticipate his drill-pipe needs and have enough stands made up and in the derrick by 8 p.m. to last until morning. Truck traffic around the site is banned between 8 p.m. and 6 a.m.

And, if it's a dry hole, it will cost about $30,000 to put the site back to its original condition and level.

A-Test Targets Set

for underground blasts in United States and Canada.

TENTATIVE SITES have been selected for two proposed underground nuclear blasts aimed at tapping vast oil reserves in the United States and Canada.

A location in northwest Colorado was picked for the first shot in the Atomic Energy Commission's "Plowshare" program, expected some time in the fiscal year starting July 1.

An initial test explosion may be set off next winter in Alberta's Athabasca tar sands if the project gains approval of the Canadian cabinet.

The Colorado project was outlined by the AEC in a report to Congress. The underground explosion will be a cooperative venture of the AEC and the Bureau of Mines. The oil industry also will be invited to participate.

The commission believes nuclear explosions can break up huge masses of oil-bearing shale so that the oil can be recovered.

Plans call for firing a nuclear device at the end of a 1,450-ft. tunnel 900 ft. in a mesa located in the Mahogany zone of the Piceance Creek basin Garfield County, Colorado.

Canadian test . . . Richfield Oil Corp., which has been pushing the Canadian experiment, has picked a site in the wilderness of northern Alberta near the outpost of Fort McMurray.

The area is uninhabited, with a railroad near enough for transportation of necessary equipment.

Dr. M. L. Natland, director of research for Richfield, says that half the oil in the tar sands—estimated by some as high as 600 billion barrels—could be recovered through use of atomic energy.

The researchers' plan is to set off a nuclear explosion 1,500 ft. underground, virtually melting the tar sands and making recovery of the oil possible for the first time. Initial test would be with a nuclear charge equivalent in power to 10,000 tons of TNT. More powerful blasts would be used for subsequent tests.

At a luncheon meeting for cabinet ministers and government officials, Dr. Natland told the group that the AEC has agreed to cooperate in the tests and to furnish the nuclear charge.

Dr. John Convey, director of Canada's Mines and Technical Surveys department, said the initial test, if cabinet approval is granted, may be tried next winter. The cabinet has set up a "feasibility committee" to study the proposed project.

O'Mahoney to Ask Imports Cut

. . . in bill to be introduced this week. Proposed law will cover both crude and products, including residual fuel.

AN EFFORT SOON will be made in Congress to take the oil-imports program out of the hands of the administration.

Sen. Joseph C. O'Mahoney (D-Wyo.) will take the initiative this week with a bill to reduce sharply the imports of both crude oil and petroleum products.

"Oil is one of our most vital resources," O'Mahoney pointed out, "and a healthy expanding oil industry is essential to our economy. Excessive importation of oil stifles our domestic industry and weakens our whole economy."

The O'Mahoney bill was being drafted late last week. It is expected to include provisions for curbing imports of residual as well as other products and crude oil.

Increased demands for residual controls followed the disclosure last week that Commerce Oil Corp. will bring Rumanian fuel to the East Coast (see p. 78).

O'Mahoney hopes to rally coal-state congressmen to the support of his bill. Several house members from coal-producing regions previously had sponsored legislation to curb residual imports. The plan is expected to face stiff opposition from big consumer states which enjoy low-priced foreign fuel.

Study under way . . . The Wyoming senator interpreted the administration's new imports study as "an indication that no action on this problem will be taken for months" by President Eisenhower.

The new study, to redetermine imported oil's effect on national security, is being made by Leo A. Hoegh, director of Civil and Defense Mobilization. Interested parties have until February 22 to file data to be considered in the study.

An additional 5 days will be allowed for recording all data to be submitted. This 5-day period ends February 27, the day before the once extended voluntary import control program is scheduled to expire.

Administration officials have given at least one strong hint that new controls now being worked out will be based on refinery runs.

Refiners queried . . . Marling J. Ankeny, director of the Bureau of Mines, has contacted about 130 refiners to determine whether their input figures as reported to the bureau could be used in setting import quotas. Such procedure would involve publication of records from individual companies.

"In the future," Ankeny explained, "import allocations may be related to certain refining inputs."

Other sources have indicated repeatedly that new controls now being devised would not cover residual.

Log Analysts Organize

WELL-LOG ANALYSTS have formed a new professional association which they hope will become international in scope.

The organizational meeting was held in Tulsa last week. Tentative name of the group is the Association of Professional Well Log Analysts.

The new association intends to exchange general and technical information, evaluate new well-logging tools and methods, publish a technical journal, cooperate with educational institutions, and set up a professional code of ethics.

R. G. Hamilton, Tulsa consultant, and temporary chairman, said the 18 charter members represent eight large companies. He said the group hopes to set up chapters in other major oil centers in the U. S. and abroad.

Temporary officers besides Hamilton include G. W. Haynes, Pan American Petroleum Corp., Tulsa, first vice chairman; F. S. Millard, Carter Oil Co., Tulsa, secretary-treasurer; and L. G. Chombart, Wichita consultant, editor. Permanent officers will be elected next month.

INDUSTRY BRIEFS . . .

An effort is being made in the Wyoming Legislature to impose a 2% severance tax on natural gas, oil, and iron. A bill which would impose the tax on the production of the three minerals, whether refined in or out of the state, was introduced by Rep. Arthur L. Buck of Laramie County and House Speaker Jay L. House of Carbon County. The two lawmakers, both Democrats, estimate the tax would produce about $6 million annually.

A bill to limit the depletion allowance on oil and gas has been introduced in the Montana legislature. It seeks to limit to 10% of net income the allowable deduction on oil and gas production in figuring a corporation license tax.

Reserves of Continental Oil have been increased through the purchase of interest in 103 oil and gas wells in West Texas. The properties were acquired from Fuhrman Petroleum Corp. Midland. The wells gross about 2,500 bbl. of oil daily from Furhman-Mascho and Munger-Nix fields in Andrews County, and Penn-Shearer and Sheffield-Ellenburger fields in Pecos County.

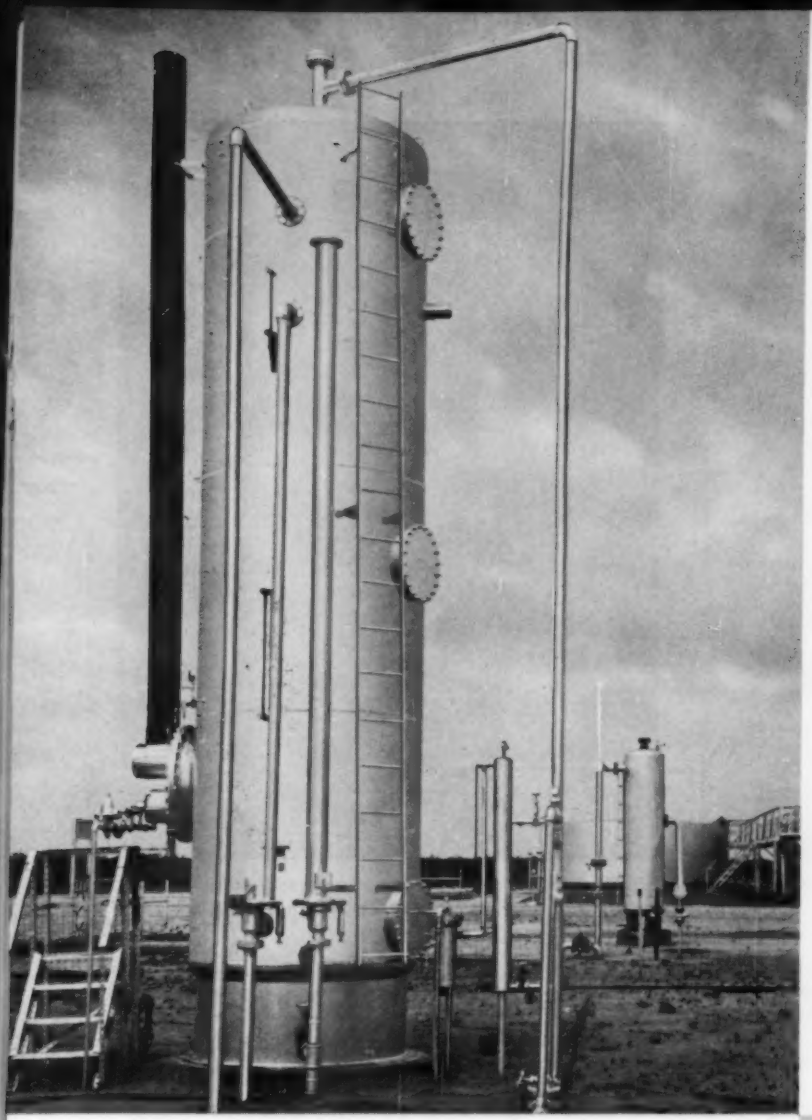
A multipurpose logging system—which gives five curves at one time—has been developed by Empire Geophysical, Inc., Fort Worth. Empire says its VS Acoustic log can simultaneously provide single receiver acoustic log; dual receiver acoustic log with 1, 2, or 3-ft. spacing of receivers and switching in the hole; choice of accompanying SP or gamma-ray log to provide lithological data; dual receiver linear velocity curve; and integrated travel time.

Assets of Trident Drilling Co., subsidiary of Bailey Selburn Oil & Gas, are being sold to Peter Bawden Drilling Co., Calgary.

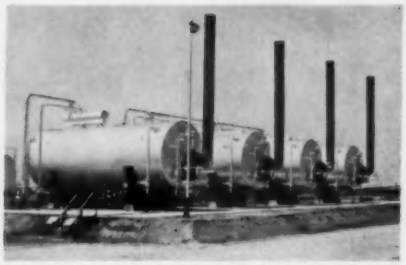
Decentralization has spread to another oil company. Sunray Mid-Continent Oil is giving exploration and production division status to offices in Oklahoma City, Denver, and Midland. A fourth division office may be established later in a Gulf Coast city.

Texota Oil Co., Denver, has acquired a working interest in 23 producing leases in the Permian basin. The leases cover net oil reserves of over 1 million barrels, double the firm's former reserves. No purchase price was disclosed. The interests were bought from Karosen Oil Co., and Atlas Oil Co., Kansas City; Julius and Leon Karosen, Kansas City, and Sam Acker and Julius Baller, New York.

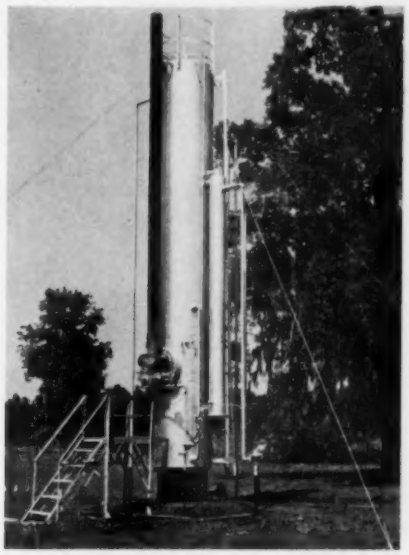
The Interior Department has proposed changes in federal oil and gas leasing regulations to permit more competition for lands formerly under lease. Under the new plan, the Bureau of Land Management would allow all interested persons at least 2 weeks in which to file applications for leases which terminated during the preceding month.



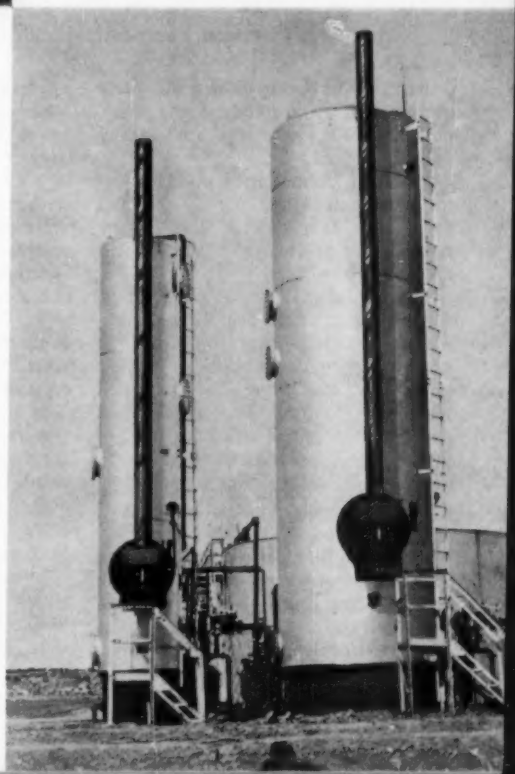
Type "S" Treaters give optimum low cost treating under average lease conditions.



"HGT" Treaters handle large volume requirements ... are excellent for tough treating conditions.



Type "J" (above) also handles "tough" treating jobs. Types "SCW" and "JCW" (below) are designed for operation in cold climates.



MATCHING TREATERS AND DOLLARS!

Don't "shortchange" yourself by operating any treater on your lease that fails to deliver maximum return per dollar invested!

No matter how "average" or how "tough" the operating conditions on your lease, BS&B has the right size and type of treater to do your job most efficiently.

Let your BS&B Man help you select the right treater for your particular lease conditions.

BS&B

ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

BLACK, SIVALLS & BRYSON, INC.
Dept. 1-A2 P. O. Box 1714 Oklahoma City

DO-IT-YOURSELF fuel cell, demonstrated by General Motors to school science classes, powers small radio.

POWER for light bulbs is provided by this Allis-Chalmers experimental fuel cell, operating with hydrogen, oxygen.

Fuel Cell: Competitor or Consumer?

• Either way, it's a long time off. But laboratory work is under way at several spots, and the long-range potential is both promising and intriguing. For the moment, though, there are a lot of problems on the road to success.

RESEARCHERS in several parts of the country are hammering away at barriers to a new source of energy —the fuel cell.

Although confident of ultimate victory, companies working on the fuel cell realize they face a long, bumpy road before perfecting it for practical use.

Spurred ahead by its possibilities, the researchers have overcome a number of problems and are attacking still more formidable obstacles in their path. For one thing, the fuel cell holds out the promise of commercial energy conversion efficiency up to 90%—more than double the 35-40% efficiency of the gasoline engine.

Oil companies' interest in the fuel cell is whetted by the fact they may use hydrocarbons for fuel.

Work is still confined mainly in the labs and pilot plants. However, one fuel cell is now in use by the U. S. Army Signal Corps for powering a portable radar set. Developed by National Carbon Co., a subsidiary of Union Carbide, it uses hydrogen and oxygen as fuel. The fuel cell, which is 1 cu. ft. in volume, has a 1-kilowatt output.

Further progress is shown by development of another fuel cell with an output rated up to 10 kilowatts per cubic foot of volume.

What it is . . . The fuel cell converts fuel directly into electrical energy without combustion.

It is basically a primary cell battery which electrochemically burns fuels to produce electrical energy. Instead of the reversible chemical reaction common to the storage battery, it simply generates energy as long as fuel is added.

Several types of fuel cells are being studied in the search for a practical unit. These include:

. . . Direct fuel cells using solid fuel.

. . . Semidirect cells consuming gaseous fuel.

. . . Indirect cells using an oxidation-reduction system (redox).

Most of the units developed so far use hydrogen and oxygen as fuel, although a variety of fuels—including gasoline, coal, and gas—can be used.

Researchers . . . Companies working on fuel cells include National Carbon, Consolidation Coal Co., Chrysler Corp., Lockheed Aircraft Corp., Esso Research & Engineering Corp., General Electric Co., Allis-Chalmers Manufacturing Co., General Motors Corp., Patterson-Moos division of Universal Winding Corp. and others.

Among the latest developments is Chrysler's DeSoto Cella I. It is a miniature model, termed the "idea car," which would be driven by four high-speed electric motors receiving energy from a fuel cell.

The motors would be adjacent to

CHECKING OVER an experimental fuel-cell apparatus are these Esso Research men at the Linden, N. J., refinery.

the wheels and would be driven by short, universal-jointed shafts to independently suspended wheels. If ultimate weight reductions are realized, it may even be possible to mount the motors directly to the wheels.

Patterson - Moos reports compactness in its fuel cell unit has been improved tenfold. The company has the U. S. license for the F. T. Bacon cell, an English, low - temperature, high-pressure unit with hydrogen as fuel and oxygen as the oxidizer. It is rated at 10 kilowatts per cubic foot at full load.

Patterson-Moos also is developing a cell to use hydrocarbons as fuel. A kerosine-spray system has been under study, as well as gases such as ethane and methane.

Esso Research has also been working on cells using hydrocarbons as fuel. Much of its research includes ethane as the feed. So far, its aim has been the house-heating field where weight and space—essential in use for engines—is not an important factor.

Allis-Chalmers has an experimental cell into which hydrogen and oxygen are fed. Hydrogen gas adsorbed on a catalyst-clad anode activates and reacts with an ion in the electrolyte to form water. This reaction releases electrons to the external circuit.

Oxygen, meanwhile, is adsorbed and activated at the cathode, causing it to react with the electrons from the external circuit and with the electrolyte. This reforms the ion which, in effect, disappears at the anode. The result is the conversion of hydrogen and oxygen to water and a flow of electrons through the external circuit. These electrons flow and perform work before the chemical reaction is completed.

General Motors has demonstrated an indirect cell using formaldehyde for fuel.

Patents have been let to E. Gorin of Consolidated Coal Co., Pittsburgh, for high-temperature cells. These are carbon monoxide, hydrogen, or a mixture of the two as fuel. The electrolyte is a special glass, and the electrodes are a mixture of iron and iron oxides.

What it means . . . To the oil man, the fuel cell is a challenge and an opportunity.

It's a competitive source of energy. But it's also a potential consumer of petroleum products. For instance, General Motors foresees fuel cells being fed conventional fuels such as gasoline or alcohol. Hydrogen and oxygen are uneconomical and tricky to handle, and formaldehyde would be uneconomical.

The biggest interest to the refiner —although it's a long way into the future—is the possibility of the fuel cell replacing the internal combustion engine.

Lockheed is working on a cell designed to produce 100 watt-hours per pound of fuel—more than sufficient to power a car. The company thinks it may develop a fuel cell capable of powering a plane within 5 years.

Patterson-Moos reports it is designing one to produce 300 watt-hours per pound.

It is difficult, at this stage of development, to compare the fuel cell with the internal combustion engine. An oil-industry authority worked up a rule-of-thumb comparison. He figured one company's fuel cell, weighing 900 lb., would drive a car for 24 minutes, while a 300-hp. gasoline engine with the same weight would run the car 1 hour. However, at 40 miles per hour, the fuel cell would operate the car as long as the gasoline engine.

Outlook . . . It will be a number of years before the fuel cell reaches the practical-use stage. Even its most optimistic champions admit to a number of problems ahead.

A practical system must be developed to handle conventional fuels. A high-output, lightweight fuel cell is essential for practical use. A high-capacity, lightweight battery is needed to handle the excess energy available when slowing down and coasting. Overcoming these problems will take time and money.

Court 'Gamble' Assailed

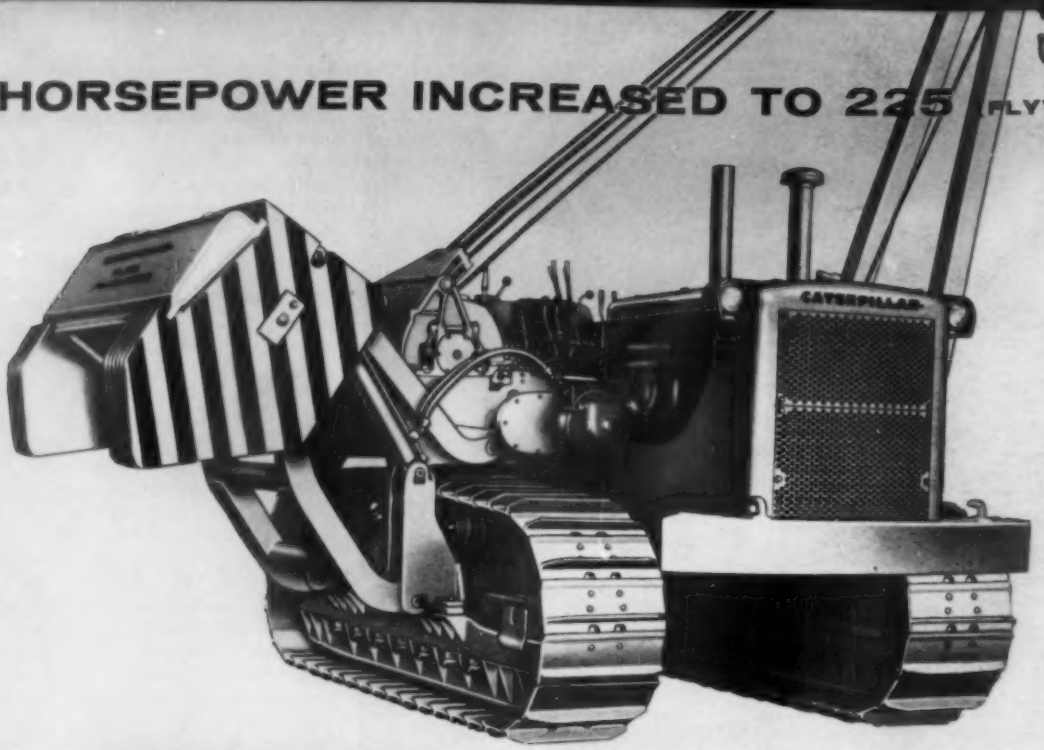
ATTORNEYS for the State of Colorado have been accused of suggesting that the state Supreme Court "gamble" in ruling on a challenge of Colorado's gross income tax on oil and gas production.

The charge was contained in a reply brief filed with the high court by The California Co. Calco is appealing a Denver District Court decision last year in favor of the state.

The Calco brief attacked arguments contained in a state brief that the U. S. Supreme Court probably would reverse a decision it made in 1935 which held that a graduated tax on gross sales was unconstitutional because it denied equal protection of the laws.

The Calco lawyers criticized state's counsel for contending the nation's highest court now has more "liberal" members than in 1935 and probably would change its earlier ruling.

HORSEPOWER INCREASED TO 225 (FLYWHEEL)



CATERPILLAR'S **PROJECT PAYDIRT**

PROJECT PAYDIRT pays off for you

NEW TURBOCHARGED

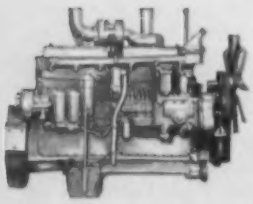
The Caterpillar No. 583 Pipelayer, the standard of spreads around the world, now is bigger, more powerful, more productive than ever. It's another major achievement in Caterpillar's all-out research program, "Project Paydirt" (see box below).

The strongest pipelayer of them all is completely new—in design, appearance and performance. It incorporates dramatic new engineering advances. It is easier to operate.

What will it do on your spread? Here's the answer:

The new No. 583 Series H has a lifting capacity of 137,000 lb.—an increase of 7,000 lb. Its counterweight suspension has been redesigned to make this possible.

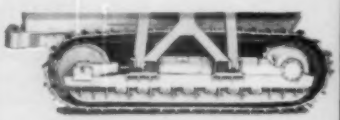
No matter what terrain the pipe takes you through, ground clearance of the No. 583 is well known. Now with it comes greater stability. Tractor gauge has been increased from 86 to 90 inches. Ground contact, with 28-inch shoes, has been increased to 7,220 sq. inches.



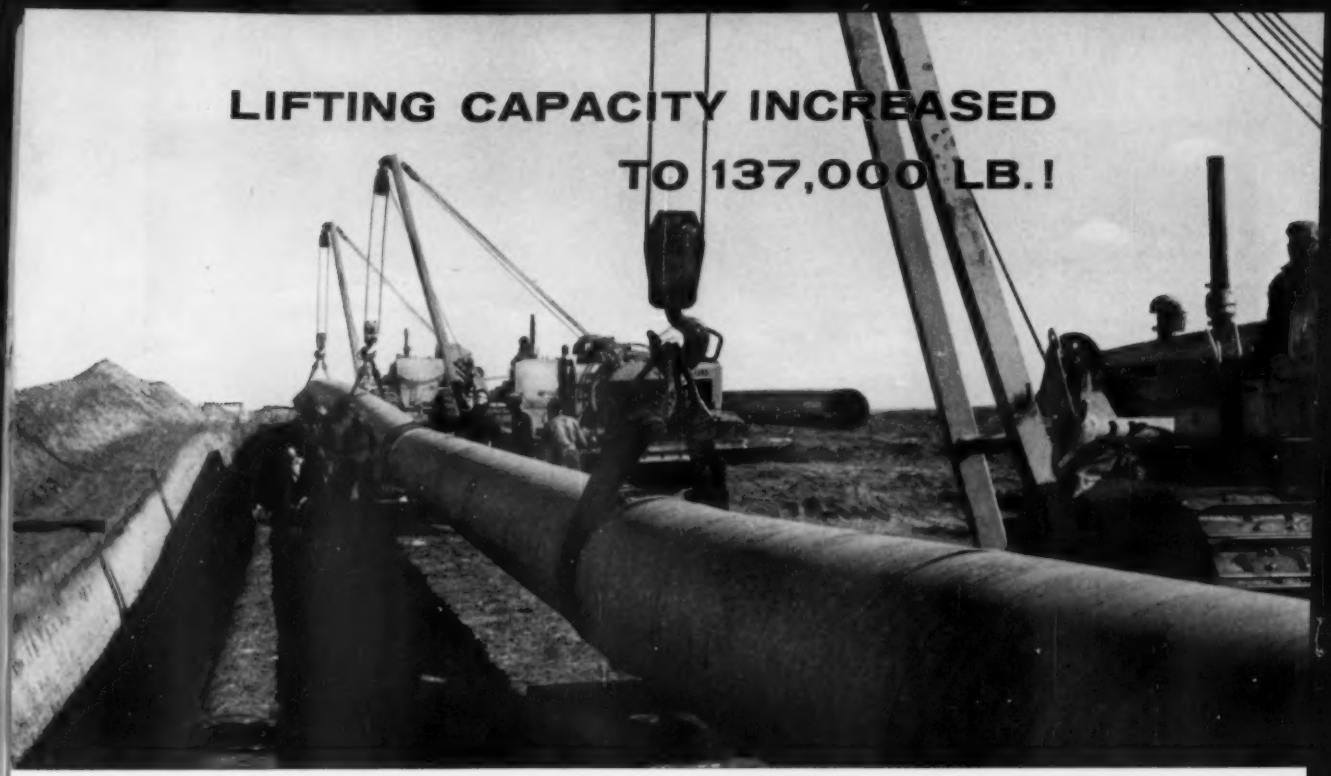
HORSEPOWER INCREASED 18%. The horsepower of the new No. 583 is up from 191 to 225 at the flywheel. In addition, over-all engine performance has been greatly improved by the addition of the efficient job-tested Caterpillar Turbocharger.

SIZE INCREASED. To make effective use of the new horsepower, over-all weight of the pipelayer has been increased 5,800 lb. to a total of 83,800 lb. Increased size means more lifting capacity. Capacity is now 137,000 lb.—an increase of 7,000 lb. In addition, counterweight suspension has been redesigned.

LIFETIME LUBRICATED ROLLERS AND IDLERS. That's right—lifetime! In a major research breakthrough, Caterpillar has achieved track and carrier rollers and idlers that never require further lubrication until rebuilding. And service life is hundreds of hours longer than with ordinary rollers.



NEW, STRONGER, HEAVIER UNDERCARRIAGE. Every component, such as frames, links, braces, pins, bushings, shoes, has been made stronger by the use of improved materials and heat treat processes to provide longer life. And 21 inches of ground clearance—a key feature—has been retained.



NO. 583 SERIES H PIPELAYER

These are only a few improvements on the new No. 583 Series H that will enable you to handle pipe faster. You will get higher production, yet the new machine is actually more economical to own and operate.

Find out for yourself. Get the full story from your Caterpillar Dealer, all the facts and figures that can only be touched on briefly here. Then see this great new machine at work on your spread as soon as possible.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

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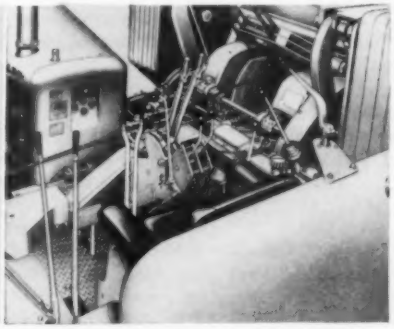
TESTED IN THE FIELD**

DRY-TYPE AIR CLEANER. Another major Caterpillar research development on the new No. 583—the new dry-type cleaner removes 99.8% of dirt in the intake air even under severe operating conditions, means greater engine protection. The new cleaner can be serviced in 5 minutes, costs a good deal less to use.



SUPERIOR OPERATION. Pipelayer controls are conveniently located with "console" mounted levers for the winches. With this new control grouping, it's easy to get accurate cradling while maneuvering the machine. And operator visibility is even better than before because of narrower dash.

MINIMUM SERVICE NEEDS

Here are just a few of the new features that reduce maintenance time:

- Greater cooling capacity.
- Double-reduction final drive to extend life of transmission, bevel gear and pinion, steering clutches and brakes.
- Transmission, steering clutches and brakes get filtered, cooled oil under pressure for longer service life. A Caterpillar exclusive.
- No steering clutch adjustments are necessary.
- Transmission, bevel gear and steering clutches have a common lube system that uses engine oil.

CATERPILLAR'S *PROJECT PAYDIRT*

PROJECT PAYDIRT: Caterpillar's multi-million-dollar research program to meet the coming challenge of the greatest construction era in history with the most productive machines ever developed.

SINCLAIR'S Edward L. Steiniger, above, is typical of the 250 U. S. ships involved as . . .

Tanker-Registry War Warms Up

• American ships flying foreign flags are the target of a two-pronged attack by labor unions and European governments. The aims are different, but the result would be the same: Higher costs would put them out of competition.

TWO CONFERENCES — an impending one in Washington and a recent meeting in London — could bring a major change in international oceanborne oil commerce.

Center of discussion at both meetings: More than 250 American-owned tankers flying foreign flags.

The maritime unions and several foreign countries want to force American tanker owners to register their ships under the U.S. flag. If they succeed, they could impair the ability of the U.S. to meet crises such as the Korean war and the Suez Canal closing.

Only apparent alternative then would be a federal subsidy something like $800 a day for each of the 250 U.S.-owned tankers.

Ten European nations and the U.S. State Department will be represented at the Washington conference.

The Europeans term the U.S.-owned, foreign-flag fleet as unfair competition. They want the U.S. ships transferred to U.S. registry or registered with one of the protesting nations.

Countries making the protest are Great Britain, France, Italy, Belgium, Holland, Norway, Denmark, and Germany—all members of the Organization for European Economic Cooperation — and Sweden and Finland. Ironically, these nations were principal beneficiaries of the tanker pool set up to offset closing of the Suez Canal.

They claim the U.S. tankers are depriving European fleets of traffic which is rightfully theirs. They also charge American owners are avoiding U.S. taxes, violating the principle of registering ships with the nation of first ownership, and are using foreign crews at low foreign wages.

Participants in the London conference were international maritime unions. They decided to exert every means at their command to compel U.S. owners of foreign-flag tankers to pay their crews U.S. wages.

What it would mean . . . Owners say if the tankers are put under U.S. registry, they would no longer be competitive.

Wages alone make the cost of operating a U.S. flag tanker about $800 a day above that of a foreign flag tanker.

Here are some typical operating costs: U.S. T-2 tanker, $1,858 per day, versus a foreign-flag T-2 at $1,079 per day; a U.S. 32,000-ton tanker, $2,192 and a foreign-flag 32,000-ton tanker, $1,317 per day.

For a year, the additional direct operating cost per tanker would be about $300,000. That adds up to an extra tab of about $75,000,000 annually for owners of the 250 tankers. If other costs are considered the overall cost increase would run much higher.

The U.S. flag tanker fleet consists of 441 vessels totaling 8,032,086 dw. tons. It can operate, despite higher costs, because U.S. coast trade is limited by law to U.S. flag tankers. Most U.S. tankers are used in the Gulf Coast-North Atlantic service.

This fleet alone would not be able to meet national emergency needs, estimated at 10,500,000 dwt. But bolstered by the American-owned tankers registered under foreign flags—253 tankers totaling 5,972,000 dw. tons—the U.S. has 14,000,000 tons under its control in case of a crisis.

The oil industry has a big stake in the outcome of the battle because of its considerable effect on international movement of oil. Oil is the most important single commodity in oceanborne commerce. It represents almost half of all such commerce.

Controversial tankers . . . The 253 U.S.-owned tankers in question are registered under the flags of Liberia or Panama.

Liberian flags fly above 141 of the tankers. Panama has the other 112 U.S. vessels. U.S. oil companies and independent tanker operators, unable to operate under U.S. flag and pay the higher U.S. wages, had to register

these ships under flags of necessity in order to compete.

They chose Liberia and Panama because their maritime laws permit control of the ships to remain in the hands of the owners. If registered under European flags, those governments would retain principal control.

Now, if an emergency arose, the tankers would immediately go into the service of the U.S. and its allies, as they did during the Korean War and Suez crisis.

The voluntary tanker pool, invoked during the Korean war, included both U.S. flag and American-owned, foreign-flag tankers. They were made available to the U.S. Government at nominal rates and saved the country an estimated $35,000,000. A similar plan, put into effect during Suez, prevented a severe economic blow to Europe.

Another reason for choosing Liberia and Panama is that these nations are approved by the U.S. Both nations were barred from the safety committee of IMCO, a UN maritime agency, by the vote of European nations over the protest of the U.S. State Department.

The Maritime administration's "trade out and build" program encourages transfers to these two countries. U.S. owners are permitted to transfer ships to foreign registry if the transferred ships are replaced with new tonnage. This has helped to build larger and faster tankers under the U.S. flag.

Liberia and Panama are dollar countries. This eliminates exchange problems in transferring profits to parent companies in the United States.

Also, Liberia and Panama do not tax income earned outside their borders. American tanker owners can use profits for tanker construction. While their income, as long as it is kept abroad, is largely tax free, any dividends or profits returned to parent companies are subject to U.S. tax.

Some companies have returned substantial amounts. Millard Gamble, then president of Esso Shipping, told a senate subcommittee that its Panama subsidiary paid dividends of $74,700,000 between 1949 and 1957.

Carl F. Vander Clute, general manager of Gulf Oil Corp.'s marine department, told the same committee that Gulf had received $19,000,000 from its foreign tanker subsidiaries. U.S. taxes were paid on these sums.

Rebuttal . . . U.S. firms with tankers registered abroad say there is no basis for the European governments' charges of unfair competition.

The American owners maintain that foreign registration enables them to meet foreign competition, but it does not give them unfair advantage.

They meet the European arguments by pointing out that:

. . . **British shipowners** have set up subsidiaries in Bermuda and the Bahamas with a tax situation closely comparable to that of foreign-registered, American-owned ships.

. . . **Both Sweden and Norway** have favorable depreciation allowances for shipping. Swedish ships are, in effect, tax free for 5 to 10 years.

. . . **Danish shipowners** pay no taxes on ships operating between foreign ports.

. . . **Norway has** a "North of Norway Plan" that makes its ships virtually tax free.

Union goal . . . Attending the London conference were the International Transport Workers Federation and two U.S. maritime unions, the National Maritime union and the Seafarers International union.

Part of the unions' objective is to bring crews of the American-owned, foreign-flag tankers into the unions.

The ITWF charges the ships pay substandard wages and permit unsafe conditions. The ship owners maintain they pay higher than going wages, that both Liberia and Panama have safety standards at least as high as European countries, and that all their ships conform to American Bureau of Shipping Standards.

The ship owners say they cannot pay the U.S. wage scale, adding up to $800 a day per ship in extra costs, and remain competitive, and that they oppose any subsidiary.

Union strategy was disclosed in December when they invoked a worldwide, 4-day boycott of "runaway ships." This boycott was effective only in the United States. The unions state further action is planned "where it will do the most good."

What will happen next, no one is sure. But with studied attacks planned by both foreign governments and the unions, it's obvious that the decisive battle in the tanker war is yet to come.

PROCESSING BRIEFS . . .

An acrylonitrile plant will be built by Ohio Standard adjacent to the company's refinery and ammonia plant at Lima, Ohio. The plant will be based on Sohio's new process, which upgrades propylene and uses substantial amounts of ammonia. Construction will start early this spring, with completion set for early next year. Badger Manufacturing has the contract. Acrylonitrile is used in manufacture of wool-like fabrics, plastics, and nitrile rubbers.

A 1,500-bbl. HF alkylation unit has been placed on stream at American Petrofina's 20,000-bbl. refinery at Mount Pleasant, Tex. The unit is part of the company's $3,000,000 modernization program, which included a 3,000-bbl. UOP Platformer. Contractor was J. F. Pritchard & Co., Kansas City.

A 20% expansion of the ammonia plant at Brea, Calif., was launched recently by Collier Carbon & Chemical Corp. Completion is slated for mid-summer. C. F. Braun & Co. engineered the plant additions with construction by Ehrhart & Associates.

A natural-gasoline plant and gathering system are being built by Sunray Mid-Continent in McClain County, Oklahoma. The $1-million plant will be the refrigerated oil-absorption type and will be able to handle 5,000 M.c.f. of gas daily when completed in July.

The world's first UOP Butamer unit is being constructed at Standard of California's Richmond refinery. Completion is expected in June. Licensed by Universal Oil Products, the unit will produce 2,000 bbl. daily of isobutane by isomerization of normal butane. It will use a fixed-bed catalyst with high activity.

Also for Refiners . . .

IN THE NEWS: Strikes shut down Gulf's Port Arthur refinery and Shell's Wood River plant (p. 63) . . . Distillate demand soars and prices firm under impact of extremely cold weather across the nation (p. 66) . . . O'Mahoney plans to get imports-control program off dead center with a control bill (p. 70) . . . Imports of residual from Rumania by U. S. firm creates stir (p. 78) . . . Researchers forge ahead with new work on fuel cells (p. 72).

PLUS THESE TECHNICAL REPORTS: Special section on field separation of liquids in oil and gas production (p. 91-99) . . . Formulating a linear-programing model for refinery simulation (p. 101) . . . Process costimating (p. 121).

Firm Buys Red Resid

. . . for sale to steel industry. Cargo of 100,000 bbl. of low-sulfur Rumanian fuel oil defended by its U. S. buyer.

SCHEDULED arrival late this month of a shipment of soviet bloc oil has added a new aspect to the import problem.

In the past it involved crude oil from friendly nations. Later, products were injected. Now products from an unfriendly nation are involved.

The impending shipment is the most talked about single cargo of oil to come to this country in years.

It will consist of more than 100,000 bbl. of low-sulfur residual. It is being imported by Commerce Oil Corp. from Rumania. It is to be blended with high-sulfur, domestic resid for industrial, primarily steel use.

It was publicly disclosed last Monday at a press conference held by Sen. Lydon B. Johnson in New York. Subject of the conference was Johnson's proposal that an advisory committee be set up to determine U.S. policy for meeting soviet economic competition.

Con and pro . . . The National Coal Association and senators from West Virginia, promptly denounced the shipment.

The association said it was the "entering wedge of a determined communist drive to dominate the American fuel market." The senators said it was "another indication of the need for protective action against the deluge of residual imports."

Harry R. Lewis, Commerce president, defended his company's action on the basis of need. Commerce Oil's main office is in Warren, Pa., with executive offices in New York and sales offices in London and Paris.

Lewis said: "This type of low-sulfur-content fuel oil is practically impossible to secure domestically in any quantity regardless of price. We have a large amount of high-sulfur-content residual fuel which comes from West Texas and California crudes containing a high amount of sulfur.

"There is a very decided need for low-sulfur-content residual fuel oil to blend with the high-sulfur fuel in order to make the high-sulfur product usable.

"In an effort to increase the availability of low sulfur content fuel oil, Commerce Oil Corp., is importing from Rumania via the Punta Spiga, a trial cargo of low-sulfur fuel oil which appears to be suitable for domestic industrial and blending needs. This product typically contains less than one-half of one percent of sulfur and is guaranteed to have a maximum sulfur content of not more than one percent.

"Our customers in Europe use this product in large quantities. It is not offered on a cut price basis but as a premium priced needed product. In addition to this, since Rumania is not on the favored nations tariff list, the duty on this oil is 15¾ cents per barrel more than the favored nations duty of 5¼ cents per barrel on other residual fuels."

No oversupply . . . Some industry sources concede that supplies of low-sulfur resid are relatively low but question if they are low enough to warrant buying from an unfriendly country.

Others say demand is brisk, that East Coast stocks are in good position, and that steel companies are not taking all that is available.

Low-sulfur resid is in particular demand by the steel industry. Steel production is up on account of the resurgence in automobile sales and inventory buying in anticipation of a steel strike (See p. 61).

A typical residual from a sour West Texas crude has a sulfur content of 3.5% and from a Los Angeles Basin crude, 1.99% by weight.

Some of the residual oil produced in Gulf Coast refineries would equal the reported low content of the Rumania Oil. Residual from some light West Texas crude also has a sulfur content of 0.5%.

Most of this country's heavy-fuel imports come from Venezuela. It is mostly from Maracaibo crude and is not suitable, as is, for such specialized uses. Lagunillas crude, for example, produces a residual oil with 3.25% sulfur and Tia Juana medium, 3.14%.

the JOURNAL *said . . .*

50 years ago

February 6, 1909

Two years ago, J. E. Crosbie obtained his first lease in Glenn pool. He now is president of Central National Bank and president of Oklahoma State Oil Co.

Union Oil Co. of California reports its refinery business up 87% last year over 1907.

While P. W. Duane of Katy, 28 miles west of Houston, burned grass on his farm, a gas explosion shot flames skyward. Four alert Houston oil men loaded augur-type drilling gear in a car, headed for Katy. Two sat on it to avoid suspicion of scouts. They crawled over Duane's acreage, sniffing for gas, asked to bore holes every 100 feet.

Producer W. H. Roeser took The Texas Co. manager Martin Moran on a field trip in his new car. A tire blew in a mudhole, the two walked to Red Fork, caught a train to Tulsa.

25 years ago

February 8, 1934

A crackdown on practice of some companies, giving discounts and rebates to customers based on artificial tank-wagon prices, is promised by Administrator Harold L. Ickes. He says a new anti-price discrimination code will be placed in effect to prevent price wars.

Consumption of petroleum products in the United Kingdom broke all records in 1933. Importations, which reflect consumption, totaled 391,563,021 imperial gallons of crude oil and 1,076,601,565 gal. of motor spirits (gasoline).

A resolution by three local coal-worker unions at Schulter, Okla., asks the federal government to tax consumption of natural gas and fuel oil as competitors of coal. Opponents branded it an effort to penalize progress and stifle competition. It was referred to House ways and means committee for study.

10 years ago

February 10, 1949

Private U. S. shipyards have 65 oil tankers on order for delivery in next 2 years.

An oil well, representing income of about $1,000 monthly, is given Boy and Girl Scouts organizations of East Texas by oil operators, headed by John Wratcher, Longview.

Alf M. Landon, former Kansas governor, asks President Truman to impose quotas on oil imports, primarily because of national defense, so U. S. producing capacity may be built up in excess of current needs. Russell B. Brown of IPAA also pleads for import controls and for congressional recognition of domestic industry's need for tubular goods and for limitation of pipe exports.

New officers of the AAPG are C. W. Tomlinson, Ardmore, president; Theodore A. Link, vice-president; and Henry N. Toler, secretary-treasurer.

no well is "completed"...

until the vital casing I.D.
has been scraped clean and smooth with a

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ROTO-VERT CASING SCRAPER

Leaves the important "working surface" of the casing permanently safe for running swabs and testers, and for setting bridge plugs, packers or cement retainers.
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★ Available anywhere, anytime; just specify Baker ROTO-VERT Casing Scraper, Product No. 620-C.

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Gas Lines Hit Anew

. . . as FPC rules "transportation service" not justified in Transco case. Commission claims such service threatens to force increases in field prices.

THE FEDERAL Power Commission has applied the brakes on the current trend of distributing companies to purchase gas at the wellhead.

In a split decision, the commission turned down the proposal by Transcontinental Gas Pipe Line Corp. to provide "transportation" service for Consolidated Edison Co., New York.

The plan would have involved construction of new pipeline facilities costing an estimated $20,000,000. It would have increased the capacity of Transco's system by 50,000,000 cu. ft. of gas per day.

Gas to be transported for the New York distributor was intended for use as boiler fuel in a Manhattan steam-electric plant, near the United Nations headquarters.

The FPC's objections centered on two points, each of which may set a precedent for future decisions:

. . . Approval of the project would pre-empt for industrial usage pipeline capacity which "otherwise would be available to meet more urgent and widely beneficial public needs."

. . . Purchases by distributors in the field, being free from the usual FPC price controls, threaten to raise rates for the "relatively limited supply" of gas.

In the same action, the FPC denied Transco's proposal to sell gas to Lynchburg Pipe Line Co. for resale primarily to an industrial user. Lynchburg had sought 6,500,000 cu. ft. of gas per day.

The FPC objected that relatively firm commitments should be required when a project depends heavily on potential industrial consumers. "Such are lacking here," the FPC declared.

"The justification for the project is further weakened by the proposed end use of the gas . . .," the commission continued.

Previous action . . . Decisions on both proposals had been deferred last September when Transco was authorized to proceed with other projects in a major expansion of its transmission system.

In an earlier ruling, however, the FPC had denied Transco's application for a permit to provide "transportation service" for Virginia Electric & Power Co. The proposed service to Virginia Electric and Consolidated Edison would have been a departure from Transco's usual policy of transporting only its own gas.

FPC's reasoning . . . Gas intended for Consolidated Edison would have replaced coal in two boilers at a Waterside plant.

The commission admitted that the idea of relieving the nearby UN headquarters of a smoke nuisance "is an appealing one," but it held that other important factors "tip the balance" against the project.

The FPC said that gas-distributing companies may find it to the advantage of their customers to seek new sources of gas in the field rather than to rely on pipelines, but it warned "grave" disadvantages may arise.

One of the dangers cited by the FPC is the threat of price increases in the field if distributors compete for their own gas supplies.

In ruling on the Consolidated Edison project, the FPC rejected the argument of its presiding examiner, William J. Costello, who held that the end use of gas need not be considered in such a proposal.

The commission cited previous FPC and court decisions in which end use was considered in respect to the sale of gas. It concluded, in effect, that the same factor could be weighed in transportation of gas for another party.

Commissioner John B. Hussey dissented from the decision insofar as it involved transportation service. Commissioner Arthur Kline concurred in the ruling, "but not in all the reasons advanced in support thereof."

Injection Starts

in Tioga and Beaver Lodge. Recovery will be doubled.

FIRST WATER has been injected in a repressuring program which is expected to increase recovery by 126,000,000 bbl. in North Dakota's Tioga and Beaver Lodge fields.

The first of four water-injection plants is now in use, and Amerada Petroleum Corp., operator, hopes to be using the other three by the end of this month. The two fields are in Williams and Mountrail counties.

Peripheral injection is expected to boost ultimate recovery to an estimated 258,000,000 bbl., compared with only 132,000,000 bbl. possible through primary means. The new recovery figure is 72% of estimated 358,000,000 bbl. original oil in place.

The units, approved last summer, take in 40,436 acres. Tioga unit is the largest, with 23,500 acres. Total number of Madison wells is 458.

The plan . . . First injection is on the east fringe of Beaver Lodge.

One other injection plant at Beaver Lodge and two at Tioga are being completed. These four plants will feed up to 31,000 bbl. of water daily to 13 injection wells. The plants are de-

PIPELINE BRIEFS . . .

A 57-mile, 20-in. line is being laid by South Texas Natural Gas Gathering Co., a wholly owned subsidiary of Coastal States Gas Producing, Corpus Christi. The 20-in. line is part of a system which also includes 9 miles of 16-in., 21 miles of 14-in., 17 miles of 10-in., and 2 miles of 8-in. from Falfurrias to McAllen, Tex. O. R. Burden Construction Corp. has the contract for the project. Coastal States and Southern Coast Corp. recently completed a 45-mile 10-in. line in Bee County, Texas.

A 75-mile, 12-in. line will be built by Northern Oklahoma Gas Co. to take gas from Grant and Alfalfa county fields in northern Oklahoma. The line will extend from near Cherokee in Alfalfa County to Ponca City. Construction is to start late this month and completion is scheduled in May on the $2,500,000 project.

One of Wyoming's important 1958 discoveries will be connected to the Sinclair Pipe Line system. The Wyoming Public Service Commission has approved an application by Teton Pipeline, a subsidiary of Western Crude Marketers, to build a 7-mile, 5-in. line from O'Brien Springs field in Carbon County. The Teton tariff will be 25 cents a barrel until cost of the $275,000 line has been recovered, then will drop to 10 cents.

Jet-fuel deliveries will be made to Griffiss Air Force Base, Rome, N. Y., through an 11-mile, 6-in. takeoff which Buckeye Pipe Line plans to build from its Syracuse-Utica line. Sheehan Pipe Line Construction Co.,

signed to handle greater capacity by adding more pumps.

Four more plants may eventually be built. At peak injection, Amerada estimates that as much as 93,000 bbl. of water daily will be injected into possibly 40 injection wells.

Only the 8,300-ft. Madison will be affected by the flood.

Signal Will Merge

with Bankline, takes option on possible refinery site.

SIGNAL OIL & Gas Co. and Bankline Oil Co. directors voted last week to merge on the basis of one Signal share for 5½ Bankline shares.

Signal would be the surviving company. The deal is subject to stockholder ratification at meetings not yet scheduled.

In the merger, Signal will pick up Bankline's 10,000-bbl. Bakersfield refinery, extensive marketing outlets, and about 1,300 bbl. daily production from 100 wells in California.

In many minds, the merger will merely cement Signal's major-company status acquired last year when it merged with Hancock Oil Co. (OGJ, Sept. 22, p. 52). The Hancock deal gave Signal total assets in the range of $500 million and made it the fifth largest producer in the state.

An option on 500 acres in Huntington Beach, Calif., as a possible site for a new refinery has been taken by Signal. It is studying plans for replacing capacity destroyed in last year's fire at the Hancock Long Beach refinery.

Oklahoma Gas Prices to Climb

. . . in south-central area following new 16.8-cent contracts for Carter-Knox reserves. Favored-nation clauses affected.

GAS RESERVES in Oklahoma's deepest producing field have been sold at a price which will trigger favored-nation clauses and boost area prices considerably.

Gas in the Deep Carter-Knox pool of Grady and Stephens counties, one of the largest uncommitted reserves in the state, has been sold to Lone Star Gas Co. and Oklahoma Natural Gas Co. The initial contract price to producers is 16.8 cents an M.c.f., about 5½ cents above the going price in south-central Oklahoma.

The deal will raise prices which ONG pays for gas under favored-nation contracts to between 15 and 16 cents, the company estimates. Substantial volumes will be affected, primarily in Garvin, McClain, Stephens, Grady, Cleveland, Caddo, and Canadian counties.

The price will increase 1.1 cents in 1963, 1968, and 1973. Producers retained processing rights on liquids from the field, which is a big condensate producer.

Reserve volumes . . . The two pipeline companies have contracted for 300 billion cubic feet with British-American Oil Producing Co., Pan American Petroleum Corp., Gulf Oil Corp., and Ohio Oil Co.

These three, principally British-American, control 80% of the reserves. Negotiations to purchase the remaining 20% from other producers are under way. Deepest producing zone in the field is 16,490-16,612 ft.

Lone Star and ONG will take 20,000 M.c.f. daily each on an annual basis, starting late this year, if Lone Star obtains Federal Power Commission approval. If Lone Star fails to get FPC approval by November 1 for an interstate sale, Oklahoma Natural, which operates intrastate only, will take the entire volume.

ONG will build about 11 miles and Lone Star 6 miles of pipeline, probably 10-in., to connect the field with nearby transmission lines.

Court appeal dropped . . . The deal has led ONG to drop a U. S. Supreme Court appeal of an FPC certificate granted to Natural Gas Pipeline Co. of America which paid 13.9 cents for recently purchased gas.

The company opposed the certificate on grounds the sale would raise the price of other contracts in the area. But last week ONG told the court that it no longer wishes to press the appeal because "the cause is moot."

It explained that competitive conditions have required the company to pay a higher price (for Carter-Knox gas) than that involved in contracts in the case which was appealed.

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which laid the Utica line last year, has the contract for the spur, which will be built in the early spring.

A record capital budget of $44,519,000 has been approved by Southern California Gas Co. for this year. Some $15 million is budgeted for transmission facilities to increase the take of gas from out of state. In addition $11 million will be spent for distribution and transmission improvements and replacements. The biggest transmission item will be pipeline and compressor facilities to handle gas which will become available by the Rock Springs project of El Paso Natural and Colorado Interstate.

A 45-mile 20-in. line from a point west of Kittanning, Pa., to Luthersburg, Pa., is planned by New York State Natural Gas Corp. This is part of a $14-million 1959 expansion and improvement program. A 14½-mile, 26-in. line will be laid from Little Marsh to near Lawrenceville, Pa. Compressor engines will be installed in Woodhull and Utica stations in New York and Preston and Tonkin stations in Pennsylvania.

LPG shipped from the Gulf Coast to Ohio on the Little Big Inch products line is moving by railroad tank car to northeastern markets. Up to mid-January 23,000,000 gal. had been shipped through the Texas Eastern line to the Todhunter, Ohio, terminal, where underground storage, dehydration, fractionation and tank-car loading facilities are located. Underground-storage capacity this summer will be 19,000,000 gal. when three caverns are completed. The terminal will have potential storage capacity of 75,000,000 gal. when fully developed.

Also for Pipeliners . . .

IN THE NEWS: Pipeliners build a 1,304-ft., 12-in. pipeline bridge across a canal in 24 hours (p. 63) . . . FPC rules Transco can't transport distributor's gas (p. 80) . . . New contracts trigger higher gas prices in southern Oklahoma (p 81).

A complete list of pipeline projects is carried in the last issue of each month. Current projects are reported in Pipeline Briefs.

PLUS THIS TECHNICAL REPORT: Double pipelines move "solid" oil (p. 112).

PHOTOS IN THE NEWS

...in Louisiana

The Methane Pioneer has set sail from Lake Charles on a maiden voyage to England that makes history. The new-type tanker before the month is out will deliver to the London area the first cargo of liquid methane ever transported overseas. It may start a new era opening markets for natural gas in previously inaccessible parts of the world.

...in New Jersey

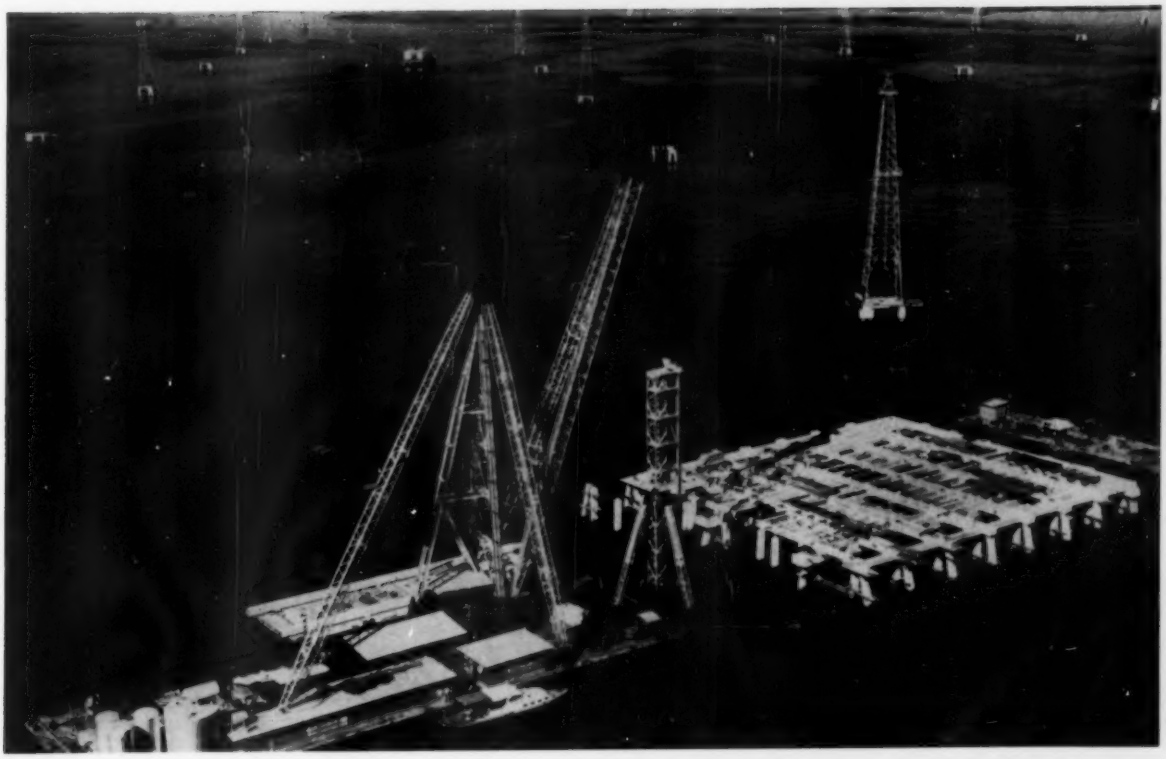
An aluminum-sheathed "beehive" of reinforced concrete houses world's largest private nuclear reactor. Ten firms, including Socony Mobil, united to underwrite the $4.5-million nuclear research center at Plainsboro.

...in Texas

Gas drilling invades city limits of Pharr in Hidalgo County. It's first well in city, which lies in both McAllen and Pharr fields. It's also smallest gas lease—only .86 acre.

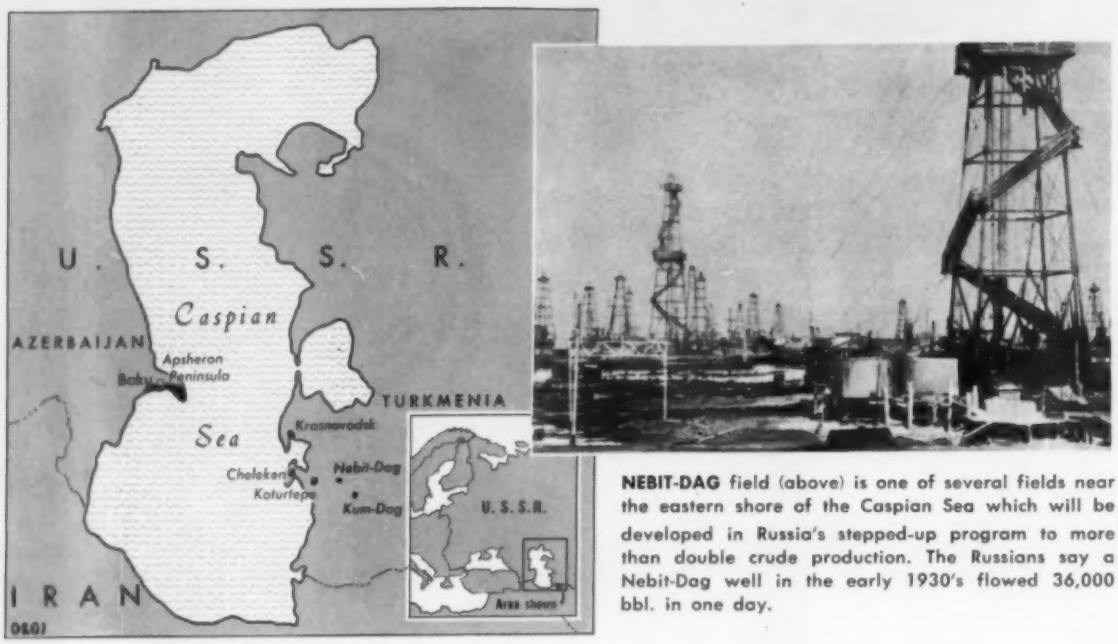
...in New York

The "A" flies uptown when Tidewater ends an 80-year residency in the Battery area and moves its headquarters to the new Getty Building on Madison Avenue. Tidewater Vice President J. G. Jimenez, left, and Assistant General Manager John W. Gendron on last trip home from old offices, pass workmen moving the company's emblem.



...in Venezuela

Creole starts building another man-made island in Lake Maracaibo. Atop the concrete piles will be placed a 1-acre platform to support a gas-injection plant, Creole's fourth in the lake. The plant is being built in 75 ft. of water and will have an injection capacity of 150-million cubic feet daily. Equipment will include seven gas turbines developing total of 56,000 hp. and seven centrifugal compressors.



NEBIT-DAG field (above) is one of several fields near the eastern shore of the Caspian Sea which will be developed in Russia's stepped-up program to more than double crude production. The Russians say a Nebit-Dag well in the early 1930's flowed 36,000 bbl. in one day.

Russia Hikes Its Crude Output Goals

• Soviets will spend $17 billion increasing production, refining, equipment manufacture, and petrochemical activities by 1965. Daily crude runs totaling 8 million barrels is ultimate aim. Eastern Caspian Sea area due for big push.

RUSSIA HAS AGAIN raised its sights on crude production aims, and its progress last year makes the new goals look entirely realistic.

The Communists in 1958 boosted crude production to 113 million tons —2,260,000 bbl. daily using a rule-of-thumb conversion of 7.3 bbl. per ton. This was a gain of 15%, or 294,000 bbl. daily over 1957. The increase was fairly close to the year-by-year rise projected in the new 7-year plan.

Here is what the Russians think they can do:

... **Produce from 4,600,000-**4,800,-000 bbl. daily by 1965, with gains between 335,000-362,000 bbl. daily per year until then.

... **Invest 170-173 billion** rubles in the industry during the period. This is from $17-$17.3 billion U. S. dollars on a realistic conversion basis.

... **Give major attention** to the eastern Caspian Sea area, where high hopes are held for the future.

The production target of 4,600,000 bbl. daily output or more in 7 years is part of the program to reach 7,000,-000 to 8,000,000 bbl. daily by 1972. The Russians have said before they would exceed the goals of the now-scrapped sixth 5-year plan, but they never indicated how much. The old target called for crude output of 2,700,000 bbl. daily in 1960.

Refining capacity is scheduled to increase a little more than double in the next 7 years. Catalytic cracking capacity will be increased 4.3 times, and catalytic reforming capacity, 16-18 times. There will be a 25-fold increase in funds allotted to petrochemical expansion. The Soviets have said refining capacity must increase 5,000,-000 to 6,000,000 bbl. daily by 1972 to keep up with crude production (OGJ, Nov. 10, 1958, p. 105).

Oil and natural gas are expected to account for 51% of Russia's total fuel output by 1965, compared with 31% at present. Coal will drop from 59% to 43%. The production timetable for gas is 14.5 billion cubic feet daily in 7 years (OGJ, Oct. 20, 1958, p. 72).

Push in eastern Caspian . . . It may be a long time before the trans-Caspian Turkmenian Republic could become a major oil province. But the Russians plan to take a hard look at the region, focusing attention on the shore of the Caspian Sea opposite Baku.

The 7-year plan calls for an increase of 80% in Turkmenia output over the 70,000 bbl. daily level in 1957. Long-range hopes are held for the Cheleken, Nebit-Dag, and Kum-Dag areas near the coast, for the Kara-Kum desert where discoveries have been made, and for the Iolata area, 500 miles southeast of Cheleken.

The first section of offshore trestle is being built on Cheleken Peninsula, opposite Baku. The trestles are used extensively in Baku operations, where 150 miles have been laid. Cheleken was an island 15 years ago until the receding water level in the Caspian formed a peninsula.

Nebit-Dag (Oil Mountain), 65 miles east of Cheleken, is the most important field in the area. Oil was pro-

duced as long ago as the eighteenth century, when the area was an island in the middle of a Caspian Sea bay. The field is now 40 miles inland, surrounded by a dry salt marsh. The Russians say one deep well in the early 1930's flowed 36,350 bbl. in 1 day.

Two other fields in the area which the Russians say are important are Kum - Dag, 25 miles southeast of Nebit-Dag, and Koturtepe, between Nebit-Dag and Cheleken.

Equipment below plan . . . The only complaint which has come to light about the operation of the industry last year was that equipment manufacturing wasn't up to expectations. There were 72,700 tons of equipment produced, a gain of 21%, but was "below plan."

The Russian Republic manufactured 3,800 turbodrills, up from 3,170 in 1957. The province normally makes about four-fifths of all Soviet oil equipment. The Russians also say more than 200 new types of turbodrills were designed last year.

Irish Plant Has Market

ONE PROBLEM ordinarily facing European refiners will be missing when the new Irish refinery opens in Cork this spring.

Owners of the 40,000-bbl. plant will have no trouble disposing of gasoline output, often a surplus product in European markets where fuel oil is king. Ireland is comparatively motorized in spite of a low standard of living. There is little heavy industry requiring fuel oil, and some of the product may be available for export to other parts of Europe.

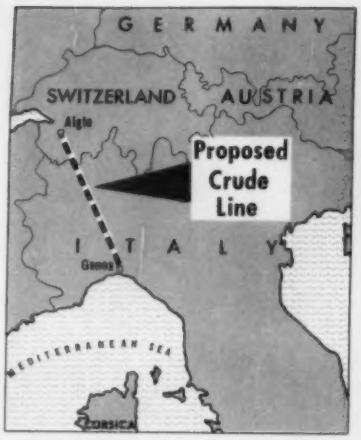
Esso Petroleum, Caltex, and Shell-Mex & BP are spending $34 million on the project. The plant is big enough to take care of growing markets for several years. Present demand is less than 20,000 bbl. daily.

Libyan Test May Be Dry

THE THIRD TEST on the Oasis Oil Co. discovery block in Libya looks like it will be a dry hole.

Thalith 1 on Block 32 is drilling ahead at 4,932 ft. The company said drilling would continue for 2 or 3 more days. The test is 6 miles south of Oasis' discovery at Dahra B-1, which yielded 38 bbl. of crude on a 75-minute test. Dahra is 24 miles south of the initial discovery at Bahi 1.

Several more locations have been staked for future wells. A test is starting at D-132, 12 miles north of Bahi. A third rig will be set up 5 miles south of Bahi.



Italy Approves Line

connecting Genoa with site of refinery in Switzerland.

A LONG-DISCUSSED crude pipeline from Genoa to Switzerland may soon become a reality.

The Italian state oil agency and Swiss investors are teaming up to build a 250-mile system from the north Italian port to Aigle, Switzerland. The agreement between ENI and Italo-Swiss Finance Co. has been approved by the Italian Government.

ENI expects the project to take 3 years. Twenty-four-inch pipe will be used in the southern part of the system, with smaller diameter pipe in the northern section. A 40,000-bbl. refinery is planned for the Aigle terminal.

Feeders may be built to cities in northern Italy later, and the system extended into southern Germany. Eventual throughput capacity may reach 300,000 bbl. daily. The partners in the program will form a joint company to raise capital for the project outside Italy.

Algeria Has Dual Producer

A WELL in eastern Algeria's Edjele field has been completed as a dual producer.

NORAFOR, a French contractor drilling in Edjele for CREPS, perforated the 129 well through a 7-in. casing between 2,590-2,630 ft. and 2,770-2,830 ft. Perforations were in the F. 4 and F. 2 zones of the Devonian.

In preparing the well for production, a Baker D retainer production packer was set at 2,670 ft. A string of 2⅜-in. tubing was set in a Baker parallel string anchor at 2,570 ft. A christmas tree equipped with orbit valves was purchased from Oil Center Tools.

Petrochem Complex

will be built in Australia adjoining Stanvac refinery.

A $50 MILLION petrochemical complex will be built at Standard-Vacuum's Altona refinery near Melbourne, Australia.

Construction will start soon on four separate plants which will produce polyethylene, polystyrene, and GRS-synthetic rubber. The plants are expected to be in production by mid-1961.

Stanvac's local affiliate, Vacuum Oil Co., Pty., will build and operate the key unit of the four-plant setup, producing ethylene and butadiene from selected end products at the refinery. The crude capacity of the 34,000-bbl. refinery is being expanded by 7,000 bbl.

Dow Chemical Co. is joining with C. S. R. Chemicals, Pty., Ltd., an Australian chemical company, to build a plant to produce styrene for use in making synthetic rubber and plastics. The company will be called CSR-Dow Pty., Ltd.

Union Carbide will build a polyethylene plant. Both will be adjacent to Stanvac's ethylene plant.

The fourth plant will make GRS-synthetic rubber from styrene and butadiene. Australian tire makers will be invited to participate in the unit.

Kuwait Line Half Complete

A BIG DEVELOPMENT project that will enable Kuwait Oil Co. to move up to 500,000 bbl. daily from northern Kuwait later this year is more than half completed.

Three wells in 4-year-old Raudhatain field have been completed for production, and casing has been set in 15 more. More oil also is being found at Sabriya, where the first well was completed as a producer in Mauddud limestone a year ago, 9 miles southwest of Raudhatain. Sabriya 2, 2½ miles due north of the discovery, is awaiting production tests.

An 80-mile, 30-in. pipeline from Raudhatain to the new North Terminal is half completed. Work also has passed the half-way mark at the terminal farm, where 15 tanks will store almost 4 million barrels of crude.

New North Pier, 4 miles south of the original pier at Mina Ahmadi, is already completed. Two 50,000-ton and two 100,000-ton tankers will be able to load simultaneously. Three 38-40-in. offshore loading lines have been installed.

Red China Speeds Work at Karamai Field

THE RED CHINESE are pushing development of Karamai field in the country's wild northwest at full-speed ahead.

Details of the field are obscure. But the Communists are now releasing photos of happy oil-field workers watching crude spurt from completed wells, and eager, if sloppy, drilling crews manning heavy rigs.

The first of more than 30 Karamai wells was brought in 4 years ago in the northwest corner of Sinkiang Province, near the Russian and Mongolian borders. The crude has started moving southward through a newly-opened, 92-mile pipeline to Tushantzu refinery.

Successful results in Karamai are part of the reason the Reds have revised upward their original crude production goal of 120,000 bbl. daily in 1962. The Chinese also are pushing development of new discoveries in the Chungking area, which are far closer to major consumption centers.

Tunisia Raps Deal

by French, Jersey in Sahara. Rebels blow up oil train.

THE NORTH African political pot is simmering again after months of comparative calm.

In Tunisia, volatile President Habib Bourguiba is charging that part of a concession granted by the French Government to Jersey Standard and other companies lies on Tunisian soil.

He says much of the acreage lies in a disputed area of the Sahara where a permanent frontier has never been fixed and is open to revision.

Tunisia has complained to both the French and Algerian rebels about the grant. Bourguiba says he is willing to take the case to the international court of justice in The Hague.

The 7,722-sq. mile block extends for 180 miles along the Tunisia-Algeria border, with the southern boundary of the concession located just south of the point where the Libyan, Tunisian, and Algerian frontiers meet. Jersey has half interest in the venture. Its partners are Cie. Francaise Petroles (Algerie), with 35%, and Petropar, 15% (OGJ, Jan. 26, p. 616).

Blast oil train . . . Algerian rebels have suddenly renewed their war against the French, and they managed to get to the heavily-guarded pipeline and rail system from Hassi Messaoud field to the Mediterranean for the first time.

A mine blew up an oil train south of Constantine, serving as a reminder that large-scale shipments of crude from the Sahara will depend on internal security in Algeria.

The attack on the temporary pipeline and rail system carrying 11,000 bbl. daily to Philippeville was the first interruption by rebels in more than a year of operation.

WORLD BRIEFS . . .

Venezuelan crude production has passed 3 million barrels daily for the first time in history. Operators averaged 3,022,000 bbl. daily for the week ending January 19. This was a gain of 78,000 bbl. daily over the previous week. The old production record was 2,974,000 bbl. daily, set the week ending June 24, 1957.

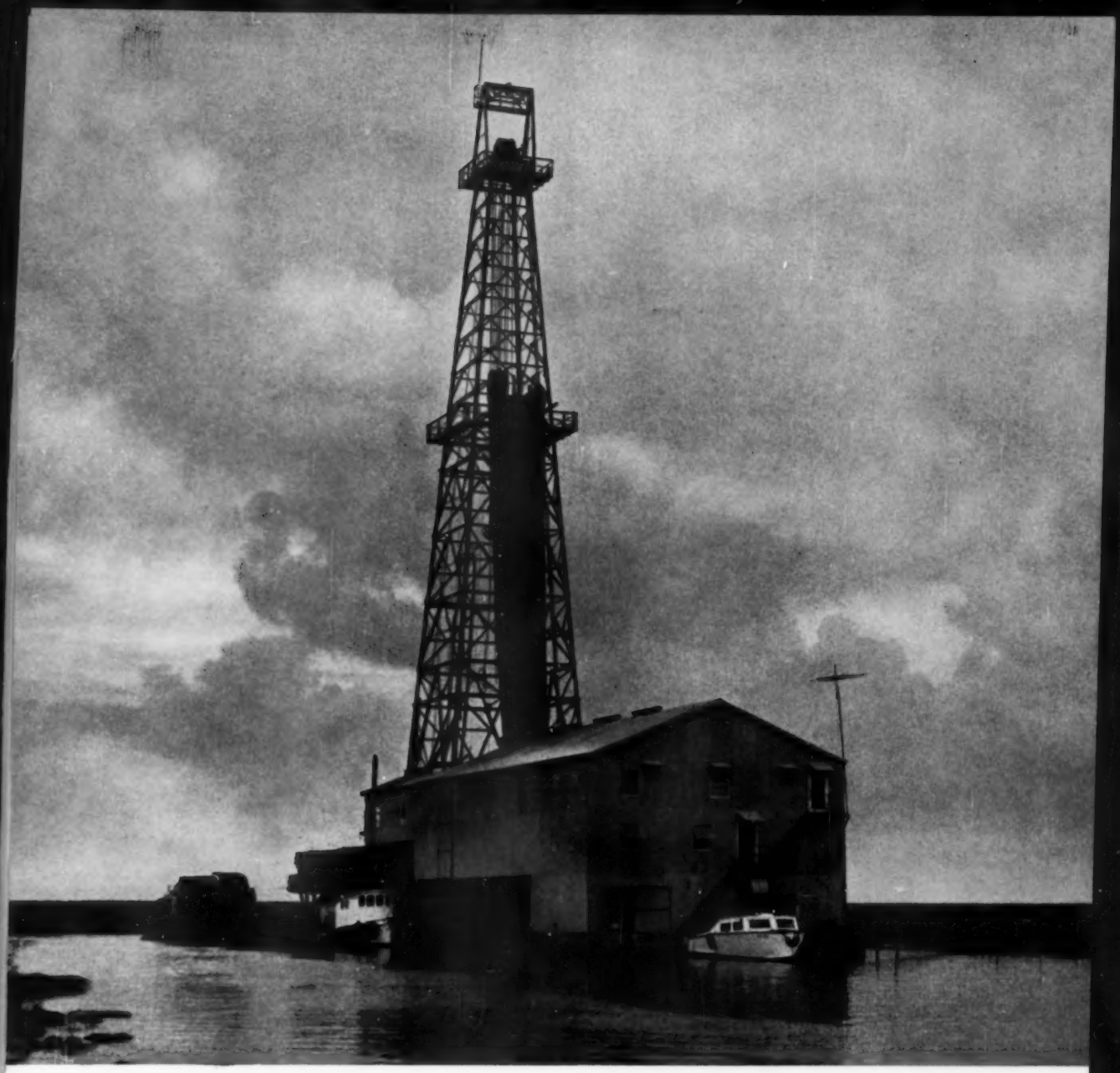
The first wildcat drilled in New Zealand since World War II has been spudded at Kapuni, near Hawera, on North Island. The Shell-BP, Todd Oil Services venture is the latest effort in sporadic drilling that started 94 years ago. About 18 bbl. daily is produced from the country's only field, found decades ago.

Norway's biggest tanker, the 48,000-ton Hadrian, is undergoing sea trials in the North Sea. It was built in Bremen, West Germany, for Hilmar Reksten Co.

A 12,000-bbl. thermal reformer has been placed on stream at British Petroleum's Kent refinery. Kellogg International designed the unit to operate continuously for at least 2,000 hours. Either of two reforming furnaces can be shutdown for decoking and started up again without interrupting operation of the other furnace.

A petrochemical plant will be part of a new refinery project in Poland. Work on the refinery will start next year, with completion reportedly scheduled for 1965. The development will be built at Plock, 75 miles outside Warsaw.

Shell Chemical (Australia) will build a $2,250,000 "Epikote" resin plant at its Clyde refinery as the next step in its expansion program. The company has opened a sulfuric acid plant at Geelong refinery, and it now will add a detergent alkylate plant there.



The BELLE CLAIRE Drills Deep. Owned by the Continental Shelf Drilling Corporation, the barge *Belle Claire* is a familiar sight in the Gulf Coast country. Here it is shown sinking a deep well at Lake De Cade, Terrebonne Parish, La. When photographed, the rig had already drilled the hole to 12,000 ft, and the crew expected to go another 4,000.

The rotary line, a Bethlehem 1⅜-in. Purple Strand rope, had been in service for almost a year. Still in excellent condition after 62,000 ft of drilling, this 6x19 line easily handled the heavy pipe and other equipment. For coring, the rig used Bethlehem 6x7 with a coating of bethanized zinc to protect against rust.

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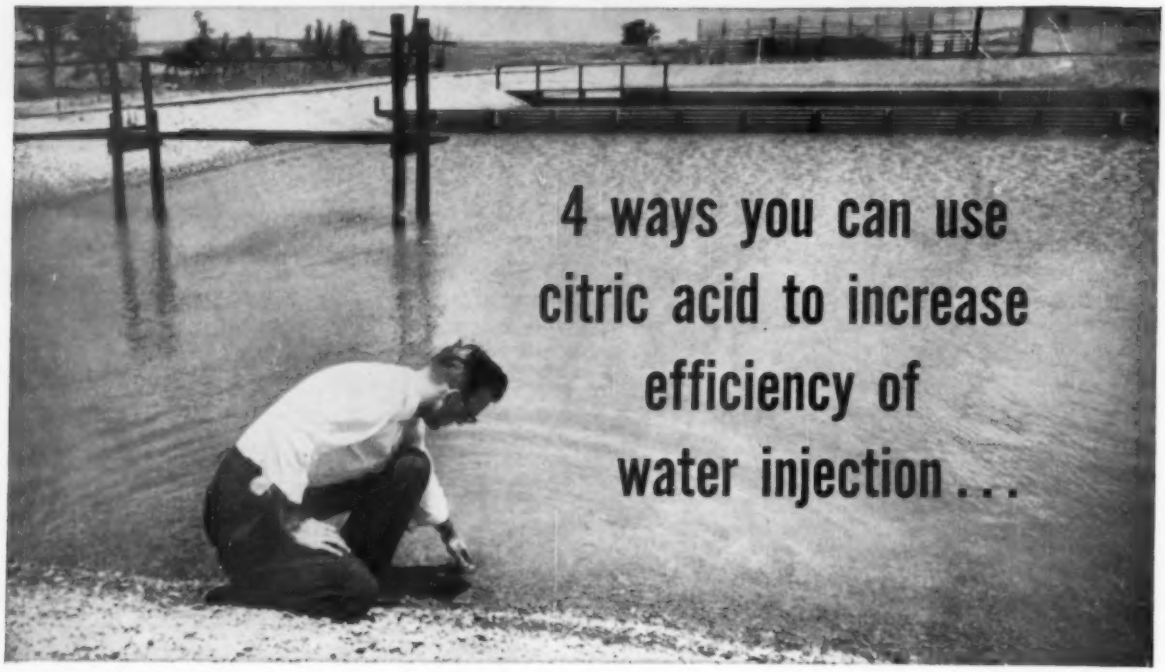
REED'S ROLLIN'

...and this is just the beginning!

Iron is probably the most serious cause of plugging problems at three out of five water flood projects . . .



The success of citric acid in increasing water injection efficiency has been proved in four distinct types of applications. Variations in water quality and operating conditions will determine which application you should use. **In each case, citric acid sequesters iron in your injection water, prevents the serious plugging action of iron precipitates.**

1. Maintenance Treatment entails the constant addition of citric acid (3:1 or 4:1 ratios of citric to iron content) to prevent iron from filtering out on the sand into which the water is injected. This, of course, helps to maintain high injection rates at normal pressures. For best results in maintenance treatment with citric acid, a water injection plant should be operating at optimum injection rates and pressures.

Two salt water disposal wells in southern Texas, with average injection rates of 200 to 400 barrels per day showed a 30 percent increase in injection shortly after only 8 ppm addition of citric acid was started as maintenance treatment.

2 & 3. Acidizing and Detergent Treatments are very important adjuncts to successful maintenance treatment. When iron plugging the sandface has already caused lowered rates and/or high pressures, acidizing with citric and hydrochloric acids or cleaning with detergents plus citric acid are excellent methods for returning the injection wells to optimum conditions.

A well in Oklahoma showed marked improvement after acidizing with a solution of 260 pounds citric acid, 25 gallons Triton* X-100, 250 gallons 15% hydrochloric acid and 500 gallons water. The injectivity index rose to 195 bbl./day/ft. of pay from 3 bbl./day/ft. of pay. Gradual decline was noted over a short period, but the index leveled at 80 bbl./day/ft. of pay.

4. Slug Treatment with citric acid is designed for those systems where the water contains iron which cannot be economically treated to keep the iron in solution, or for those systems where the iron is completely precipitated before the water can be treated. Slug treatment at 500 ppm once every 4 to 6 weeks sufficiently lowers the pH to dissolve much of the insoluble iron, and the cost of treatment is low when averaged over this period of time.

A well in southern Louisiana was treated by slugging with two 400-pound batches of citric acid, two weeks apart. Injection rates have more than doubled, from 4,000 to 8,640 barrels per day, at last report, and in addition, the pressure has averaged 300 psi lower than previous requirements.

Other operators have noted good results because of less frequent downtime on filters, and less replacement of parts because of rusting. If water flooding is your business, and you would like complete information on the use of citric acid for iron sequestering, write the Pfizer Chemical Sales Division today.

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FIELD SEPARATION OF LIQUIDS

IN OIL AND GAS PRODUCTION

THIS PANEL OF EXPERTS discussed the field extraction of natural gasoline and LPG from natural gas at a recent NGAA meeting in Amarillo. Panel moderator, at left, was A. J. Miller, Phillips Petroleum Co. Next are Fred E. Cooper, B. W. Bourne, A. W. Francis, and J. Roger Heumann.

Cooper is chief engineer for Parkersburg Rig & Reel Co. He has been with this firm since he graduated from Rice Institute in 1950.

Bourne is Houston area sales manager for Delta Tank Mfg. Co., Inc. Since his graduation from Oklahoma University in 1946, he has worked 10 years for Black, Sivalls & Bryson, and 2 years for Delta.

Francis is vice president for sales at National Tank Co. After his graduation from Oklahoma University in 1936, he served briefly with Phillips Petroleum Co. He has been associated with National Tank Co. since 1937.

Heumann is in the oil-field division of Black, Sivalls & Bryson, Inc. Since his graduation from Oklahoma University, he has served 6½ years with Stanolind Oil & Gas Co. and 4 years with B. S. & B.

1. How the various processes compare in payout

BY FRED E. COOPER

THE PRIMARY process aim is to extract the most liquid hydrocarbons out of the stream.

Considerations controlling choice of method to be used are: Line pressure (whether you are feeding into a low or high-pressure gas line); wellhead pressure; the liquid content of the stream; the sale of the fluid; and whether dehydration is necessary.

Process comparison . . . Fig. 1 compares liquid recovery from a typical lean stream using four commonly used processes: (1) conventional separation; (2) low-temperature separation by expansion, (3) low-temperature separation by auxiliary refrigeration, and (4) hydrocarbon recovery by adsorption in short cycle dry-desiccant units.

As you would expect, the least recovery is obtained from the conventional separator. Initially, producing from a 2,500-psi. reservoir, the heater-separator installation may produce 2 to 2½ bbl. of oil per M.M.c.f. of gas. With the decline in reservoir pressure and subsequent retrograde condensation, the amount of liquid falling out in the separator reduces.

Utilizing the 250-psi. pressure available, the process of low-temperature separation can be employed. The lower the operating temperature, the more liquid condenses. At 2,500 psi., for instance, the recovery increase over the conventional separator will amount to 2 to 3 bbl. per M.M.c.f. As the pressure falls off, the same effect occurs in the reservoir in the amount of fluid that is produced in the vapor state.

Along with that, of course, when you lose wellhead pressure, you lose the pressure drop that is available and you end up with a higher separator temperature. That reduces the amount of liquid dropout.

To achieve that same effect of low-temperature separation, you can use an auxiliary refrigeration unit to keep a constant low temperature and to achieve a maximum dropout of liquid.

Solid-desiccant units . . . Then of course there are the solid-desiccant, short-cycle units that can extract from the vapor state an additional amount of recoverable gasoline over and above what will form or drop out by the gas-to-liquid equilibrium. There you see the dry-desiccant wellhead-unit type of recovery.

After passing through either of these four types of equipment there will be some recoverable hydrocar-

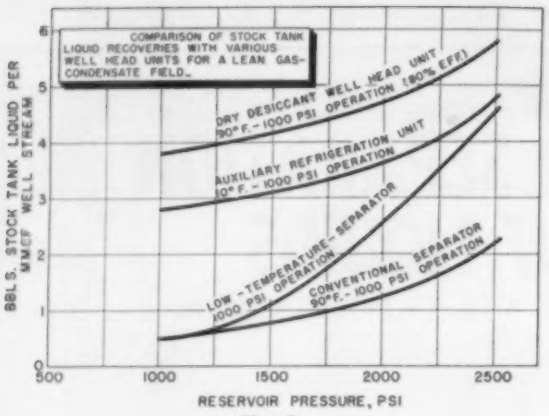

COMPARISON OF STOCK TANK LIQUID RECOVERIES WITH VARIOUS WELL HEAD UNITS FOR A LEAN GAS-CONDENSATE FIELD..
DRY DESICCANT WELL HEAD UNIT 90° F. - 1000 PSI OPERATION (80% EFF.)
AUXILIARY REFRIGERATION UNIT 10° F. - 1000 PSI OPERATION
LOW - TEMPERATURE - SEPARATOR 1000 PSI OPERATION
CONVENTIONAL SEPARATOR 90° F. - 1000 PSI OPERATION
BBLS. STOCK TANK LIQUID PER MMCF WELL STREAM
RESERVOIR PRESSURE, PSI

Fig. 1.

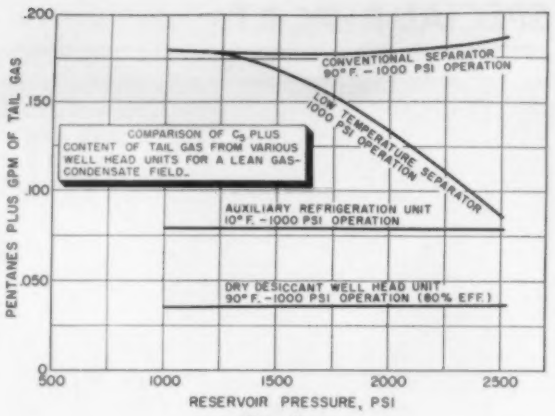

COMPARISON OF C5 PLUS CONTENT OF TAIL GAS FROM VARIOUS WELL HEAD UNITS FOR A LEAN GAS-CONDENSATE FIELD..
CONVENTIONAL SEPARATOR 90° F. - 1000 PSI OPERATION
LOW TEMPERATURE SEPARATOR 1000 PSI OPERATION
AUXILIARY REFRIGERATION UNIT 10° F. - 1000 PSI OPERATION
DRY DESICCANT WELL HEAD UNIT 90° F. - 1000 PSI OPERATION (80% EFF.)
PENTANES PLUS GPM OF TAIL GAS
RESERVOIR PRESSURE, PSI

Fig. 2.

bons left in the gas stream (Fig. 2). Of course, the amount of available recoverable gasoline that would be left in the stream would vary. You can see that the conventional separator leaves by far the most gasoline in the stream. The low-temperature separator, if it has full-pressure drop available, can recover a larger percentage; but as the pressure falls off, it leaves more and more in the stream.

An auxiliary refrigeration unit, which would mean no increase in the separator operating temperature, would keep a near-constant amount of recoverable gasoline in the exit stream. Here again the solid-desiccant unit, having the ability to adsorb gasoline, would recover still more and leave a drier stream.

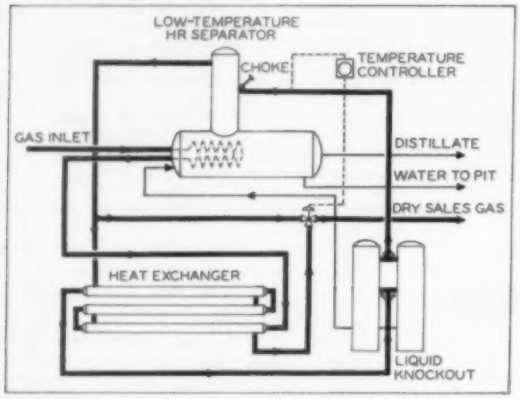
When the inlet stream is richer than that shown in Fig. 1, more available pentanes-plus will be left in the outlet gas from these units.

Fig. 3 is a typical process flowsheet for a low-temperature unit. It utilizes pressure drop to get a low operating temperature to achieve maximum dropout. This process uses the well stream itself as the heating medium to melt out the hydrates that form in this expansion. This particular design is most effective in keeping cold gas away from the warm fluid, thereby getting colder gas temperatures and, of course, the maximum liquid dropout.

This warm coil gives stabilization to the fluid so that you are boiling out many of the undesirable light fractions that would be lost in the flash to the tank anyway.

The production problems of water and liquid dropping out in the line instigated the use of small solid-desiccant, short-cycle units that could be used on wellhead installations, for instance, to dry up the stream.

The unit was small enough to be applicable on wellhead installations. It was a primary dehydration unit so small that there is not enough desiccant in it to do much liquid extraction of hydrocarbons. The desiccant becomes saturated with water vapor and does not leave pore space available for getting maximum hydrocarbons.



(Left)

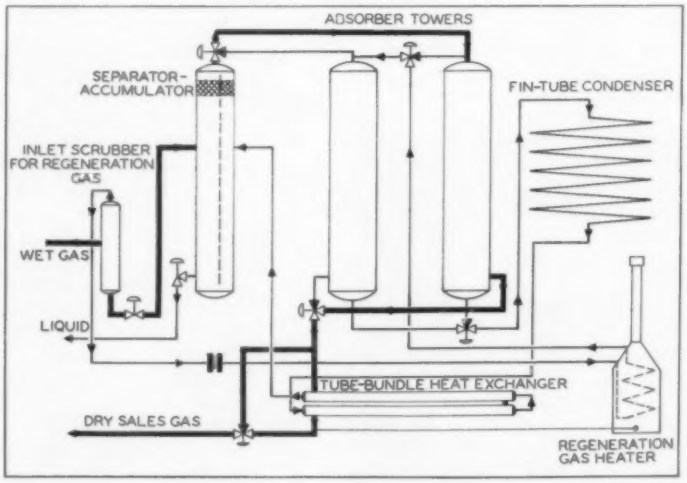
TYPICAL process flowsheet, low-temperature unit, for field recovery of hydrocarbons. Fig. 3.

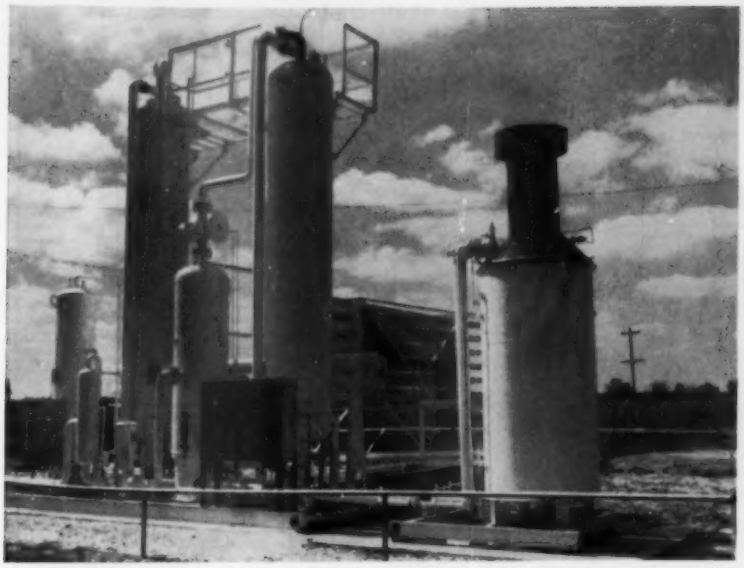
(Below)

SOLID - DESICCANT unit for hydrocarbon recovery and dehydration under field conditions. Fig. 4.

Short-cycle payout . . . In the process of dehydrating with these small, short-cycle units, we found a payout on hydrocarbons recovery was possible if you could shorten the cycle time to limit the amount of water vapor adsorbed by the desiccant and allow that capacity for hydrocarbons (Fig. 4).

In shortening the cycle, you can decrease the size of the unit. This is what we call a Type 2, dry-desiccant, short-cycle unit. It is for the recovery of hydrocarbons with dehydration secondary, and the unit is very capable of extracting the pentanes-plus frac-





TYPICAL SOLID-DESICCANT UNIT operating under field conditions. Fig. 5.

tion to the amount shown on the previous slides.

Fig. 5 is a typical Type 2 unit with recovery of about 40 bbl. per day total from this unit. Shortening the cycle further increases the recovery still more. We do that in a system with three towers where we flow through one, regenerate one, and cool the other. With this system we are able to shorten the cycle from 30 minutes on the other type of unit to about 11 minutes in this, which means that the gas passes through the adsorbing tower only for 11 minutes.

The desiccant is thus maintained in a very unsaturated condition, so that it has high adsorptive capacity at all times and adsorbs all of the gasoline fractions.

One of our typical three-tower installations gets the pentanes-plus fraction down to 80 to 85% of what was originally in the stream, and a total volume of fluid equivalent to over 100% of the available C_5.

2. Building a closed-system adsorption-type unit

BY B. W. BOURNE

FROM THE DAY the first gas stream was produced, the removal of liquids has been a problem. The industry has progressed through the use of the simple line drip, separators, cold separators, and finally separators that are refrigerated. These devices are of a mechanical nature and can only separate the liquid and gaseous phases of the stream passing through the vessel. It is obvious that any material in the vapor phase cannot be removed by simple mechanical separation.

There are two basic methods that are used for the separation of the various components that exist in the passing from the simple separator: (1) adsorption and (2) oil absorption. In adsorption, the material is taken from the gaseous phase and retained on the surface of an adsorbent. The more familiar of the adsorbents are the charcoal, silica gel, and the activated alumina.

In oil absorption, liquid is used to contact a mixture of gases and some of the components are preferentially absorbed. After separation of the components by either process, the retained components are vaporized and condensed. The liquid thus condensed is the product.

Problem not new . . . In any commercial enterprise, the matter of economics is of paramount importance. Although the industry has been keenly aware for years that millions of dollars in valuable products were going down gas pipelines, in many cases it has not been economically feasible to recover them. Where the stream of gas is relatively rich in components that might be recovered as liquids, profitable, but perhaps inefficient, processing is relatively simple. In such a case, simple cooling and separation of the components, with a possible stabilization step in the treatment of the liquid, is a paying proposition.

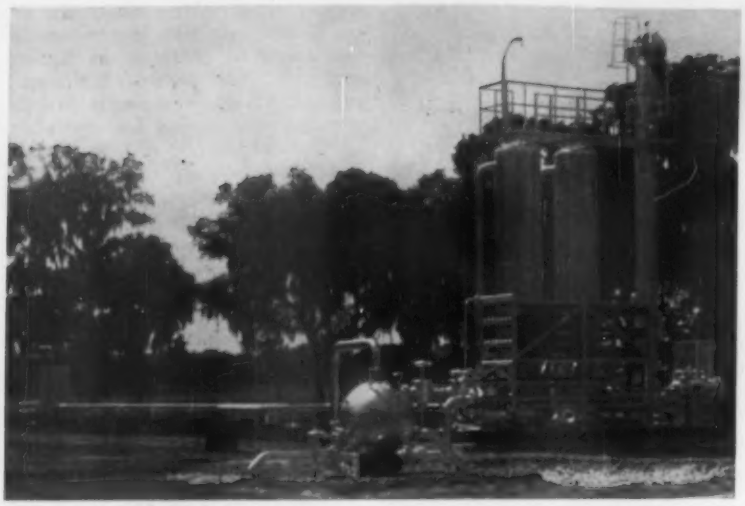
However, in any such plant there has to be an appreciable quantity of products that goes down a gas pipeline from the separator where the liquid is taken out. There has been no way developed to simply condense 100% of the desired fraction from the mixed-gas stream. What this amounts to is that where there is a large quantity of products to be recovered from a stream, processing is economically possible while a sizable quantity of product is left in the gas. This is true of a simple cooling and separation system.

As the amount of recoverable product in a stream decreases, the cost of cooling the mass of the gas increases to the point where it is not profitable to cool the entire gas stream to extract the product. For the leaner streams of gas, more efficient recoveries may be obtained by oil absorption. By the very nature of an oil-absorption plant, it usually must be fairly sizable to attain efficiency of operation—that is from an economic approach. When the stream of gas under consideration is very lean, oil absorption cannot be profitably employed.

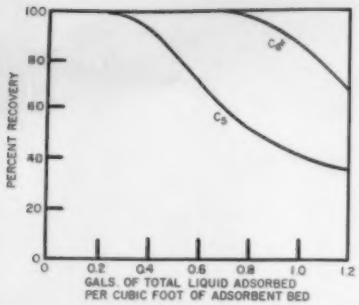
During the past 5 or 6 years, work has been progressing to the development of an economical, practical recovery system for the orphan gas streams. The approach has been by the adsorption process, rather than either cooling and separating or by oil absorption. Basically this problem could be very simple. All that must be accomplished is to catch the desired fractions in a gas stream as it passes through a bed of absorbent material and recover it in a liquid state from there.

Such a process has been known for many years. Over 30 years ago plants were built and operated using charcoal, and some of them attained a fair degree of success. Dry-type dehydration plants have been built and used for years for the removal of water vapor from streams of gas and some hydrocarbon liquid is recovered along with the water. Then why not work on this system to increase the recovery of hydrocarbons from the gas? It should be just a matter of efficiency.

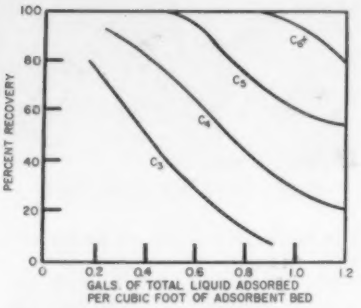
Occasional checks of conventional dehydration plants revealed that the desiccant was used very inefficiently.



TWO-TOWER DRYEX UNIT operating in Gulf Coast area. Fig. 6.



RECOVERY OF HEAVIES from gas stream using silica gel. Fig. 7.



COMPONENT RECOVERY using silica and charcoal. Fig. 8.

In many instances the beds were greatly oversized. Basically, the problem of efficient use of adsorbent material is very simple. Saturate any given quantity of desiccant to the desired degree, regenerate the bed, cool, and resaturate. There is no mention of the time required to do the above operations. Sometimes the obvious is the thing that goes without notice. It follows that the shorter the time required to saturate and regenerate the desiccant, the more material will be recovered in any given period.

New process . . . As a result of such an approach to product recovery, the Dryex—a dry-desiccant hydrocarbon-recovery unit utilizing a closed regeneration system—has been developed. The years of experimenting and developing brought to light several problems, which is somewhat of an understatement. A fairly comprehensive account of the Dryex unit was presented by Dr. Willard Dow at the recent Casper meeting of NGAA, and published in The Oil and Gas Journal, November 3, 1958, p. 75. Anyone needing detailed information on the actual performance of these units, etc., may refer to that article.

There is not a doubt at this time that the Dryex hydrocarbon-recovery unit is here to stay.

As a matter of fact, there is some evidence that they will encroach in the field of oil-absorption plants. There is a plant currently operating that is recovering from a very lean stream essentially 100% of the iC_5-plus fractions, 80% of the C_4's, and 40% of the C_3's in the liquid state. There is another plant operating on a gas stream which has been processed in a low-temperature unit at 28°. The recovery of stable stock-tank liquid is 70 bbl. per day from approximately 35 M.M.c.f.

The Dryex units have been developed to operate without an attendant. There is not even a clock to wind to keep the cycles going. Likewise no cooling water is required. In some areas this is quite an important factor. Although there is always room for improvement, the development of the Dryex unit is essentially completed.

Dryex installations . . . Fig. 6 is a typical two-tower Dryex unit operating on quite a lean stream in the Gulf Coast area. It recovers about 52 bbl. a day and utilizes a gas-driven pump on a closed regeneration system. Fig. 7 is a curve which shows the approximate per cent recovery of heavier fractions from a gas stream, using silica gel. Normally the beds are saturated from 0.6 to 1.0 gal. per cu. ft. The per cent recovery as stock-tank liquid approaches 100% of the C_6's and somewhere in the magnitude of 50 to 75% of the C_5-plus fractions.

A typical four-tower Dryex system utilizes a bed containing a combination of silica gel and charcoal. This unit is operating downstream from a low-temperature system which processes at about 10°. It is a unit where we are recovering approximately 100% of the C_5's, about 80-85% of the butanes, and some 43% of the propanes.

Fig. 8 shows the per cent recovery of each of the components using silica gel and charcoal. Normally in saturation of charcoal we operate somewhere in 4 to 8% which gives a recovery of essentially 100% of the C_5-plus fractions, somewhere in the magnitude of 60 to 85% of the C_4's and 35 to 50% of the C_3's.

3. Low-temperature separators and combination units

BY A. W. FRANCIS

THERE is an application for low-temperature separators **and** hydrocarbon-recovery units used in combination. The hydrocarbon-recovery units tend to supplement low-temperature separation and do not supplant it. The combination of the two will give a better range of effective sizing. If low-temperature separation is used in the early and more productive phases of the field, one can build the hydrocarbon-recovery unit for a large volume, relatively speaking, of lean gas and let it process, at a later date, a smaller volume of a much richer gas.

Economic Study

With that utility in focus, let's ex-

amine an economic study. This study is on a relatively lean stream of condensate of 12 to 16 bbl. condensate per M.M.c.f. of gas. In this study, we took three different plants. Plant A is designed to remove a liquid volume equivalent to about 65% of the iC_5-plus in the stream from a separator operating at 70°. Incidentally, the iC_5-plus content of that stream runs 0.229 gal. per M.c.f.

In comparison to that we took a plant which was designed to recover a liquid volume equivalent to better than 80% of the iC_5-plus from that type of stream and compared the economics of those two plants against a combination of low-temperature separators operating at 10° and feeding that stream into a short-cycle hydrocarbon-recovery unit.

It should suffice to say that in any economic study considering the use of hydrocarbon-recovery units, some accounting certainly has to be made of the gas shrinkage and the gas that is flared as a result of the liquid recovery. Any study that does not take that into consideration is leaving out a rather important phase of the economic problem.

Plant A in this particular case was estimated to install for about $126,000. It is designed to recover about 104 bbl. of liquid from 30 M.M.c.f. of gas. The payout time on Plant A is a little over 18 months.

Second plant . . . Plant B is designed for liquid recovery equivalent to 80% or better of the iC_5-plus. The installation cost is approximately $170,000. Payout of Plant B figured out almost the same as Plant A—about 18 months. Of these two plants, Plant B appears to be the better investment.

Plant C uses the combination of low-temperature separation operating at 10°, and a solid-desiccant unit. The wells under consideration had flowing pressures capable of producing at 10° separation temperature. In designing this hydrocarbon-recovery unit to process 30 M.M.c.f. of gas with 0.11 iC_5-plus content it was recognized that later on it would need to process 15 M.c.f. of gas of a 0.229 gas leaving a separator operating at 70°.

The installed price of the low-temperature process equipment plus the hydrocarbon-recovery equipment is approximately $166,000. The payout time, taking into consideration the expense of the flare gas—which in this particular case ran to $611 a month for the low-temperature unit and $492 a month for the hydrocarbon-recovery unit—was 13 months, or about 40% faster with the same amount of investment as in the case of Plant 3.

4. Low-temperature processing has built-in flexibility

BY J. ROGER HEUMANN

THE LOW TEMPERATURE required in low-temperature separation depends upon choking to obtain the degree of refrigeration needed. If high pressure is not available, an external source of refrigeration is required. To fill this need, an absorption refrigeration unit was developed. It was designed around oil-field components and controls that will stand up to the rugged conditions found in the industry.

Fig. 9 shows this unit. The equipment outside the dotted line is the same as a normal low-temperature installation. This is only one of the many variations of this process which are available. In this instance, we have substituted a chiller in place of a choke. The chiller consists of a gas flow coil immersed in a bath of boiling liquid ammonia, with the controls necessary to feed more liquid ammonia into the vessel as needed. The equipment inside of the dotted line is the ammonia refrigeration unit.

Water absorbent . . . Water, suitably treated with a chemical corrosion inhibitor, is used as the absorbent. The rich ammonia - water solution is pumped through the feed-bottoms exchanger and into the still column where the lean solution comes back to the feed-bottom exchanger by means of a conventional liquid-level control and diaphragm valve. Then, after filtration, solution is admitted into the absorber through spray nozzles where it picks up the vaporized ammonia coming from the chiller and falls to the bottom of the vessel.

A water-cooled tube bundle in the lower section of the absorber removes the resulting heat of absorption as it is produced. A partial condenser in the top of the still column provides the necessary reflux while the remaining ammonia vapor coming from the still column is condensed in the final condenser and is fed to the chiller as a liquid.

The chilling is controlled by the rich-solution pumping rate, which in turn controls the amount of lean solution sprayed into the absorber. The absorption process was chosen primarily to keep the number of moving parts to a minimum.

This greatly increases the dependability of the unit and decreases the labor and maintenance required. The only moving parts other than controls are the rich-solution pump and the cooling-water pump.

Unattended operation . . . The ability of the ammonia-absorption unit to operate on an unattended basis is one of its outstanding features and is certainly an important consideration when selecting field-processing equipment.

The components used are familiar to most pumpers and roustabouts. Neither special training nor experts are required to operate and maintain the unit. Spare parts are kept to a bare minimum. The ammonia used to charge the system is fertilizer grade which is available in most farming communities and sells for only a fraction of the cost of refrigeration-grade ammonia. The operating characteristics of the ammonia absorption process make it particularly well suited to field operations.

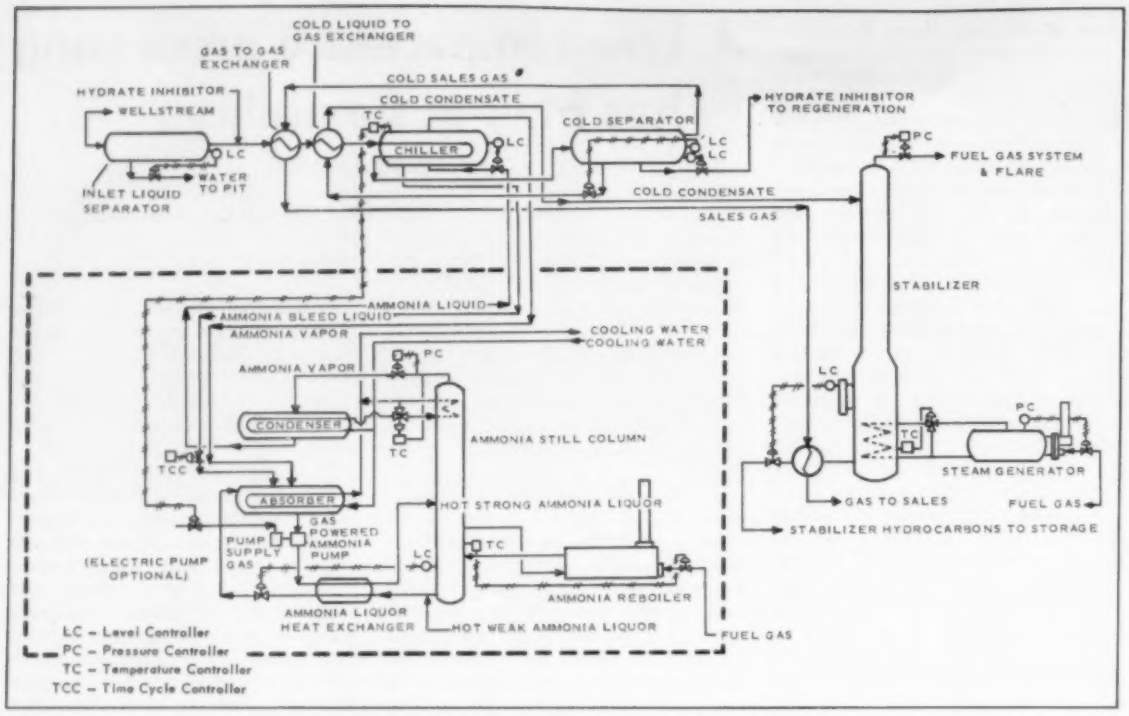
These characteristics are such that lower chiller temperatures do not materially decrease the capacity of the unit, and operating costs vary directly in proportion to the load. The process is easily controlled and will adjust from a no load to a full load automatically. This type of flexibility is not available in most of the other processes.

All vessels with the exception of the still column are horizontal, which makes for an easy and inexpensive installation.

Skid mounting . . . The components lend themselves readily to skid-mounting. Although vertical, the still column is short, about the same height as an emulsion treater. The unit is free of vibration and requires only a simple foundation. It is not necessary to provide a house for the equipment. This type of process finds its best application on rich streams at moderate pressures. Gas-condensate wells offer probably the best potential application, but by no means is this the only place it can be used.

If you have existing low-temperature units on which the pressure is declining, ammonia-absorption refrigeration can be added in order to produce the low temperature no longer available by choking.

When considering new low-temperature installations, it is well to plan



ABSORPTION REFRIGERATION UNIT for use in the field. Fig. 9.

the unit with such expansions in mind. For example, choke high-pressure gas for your initial refrigeration requirements during the early life of the well, add glycol injection later as the pressure declines, and use ammonia-absorption refrigeration a few years after the glycol unit.

Expandable facilities can be very attractive when you consider the additional advantage of deferred investment. Separator or treater gas which is being compressed for sale can be processed for hydrocarbon recovery and dehydrated, both with the same process. A number of separate well streams with individual chillers can be handled by one basic ammonia unit. As you know, that problem comes up when it is necessary to produce and meter well streams without commingling.

Economically, the quantity of gas produced is not nearly as important as the liquid content of the stream and its available processing pressure. After all, it's the total gallons being produced which will pay for your installation.

AMMONIA ABSORPTION UNIT installed next to low-temperature-separation skid. Fig. 10.

Field installation . . . Fig. 10 shows an actual field installation of an ammonia-absorption unit installed next to a low-temperature separation skid. There is no easy or quick way to determine accurately what refrigeration will produce from a given stream without running some calculations. This means a good well-stream analysis will be required in order to design equipment to fit your particular need.

Each gas stream must be considered as a separate problem and the process best suited to its need should be applied.

When high-pressure gas is available, and the stream is rich, low-temperature separation with a choke will usually give the best results for the least investment. Rich streams without a high-pressure drop available will fit the ammonia-absorption refrigeration unit, and for lean streams, short-cycle, dry-desiccant units are fast showing merit. Careful equipment application is the key to economical processing.

5. Question-answer session

Q. Can any substantial amount of butane or propane be recovered by a dry-desiccant unit?

Cooper: Yes, to a certain extent. The limitation of propane recovery, of course, is the shortness of the cycle and the ability to adsorb propane. Once it is adsorbed, it has to be condensed and that is the function of the temperature, the pressure, and the concentration of the stream.

By lowering the temperature sufficiently in the condenser, a substantial amount of propane can be recovered. It can be processed then into a depropanizer and recovered as in a conventional gasoline plant.

Q. What percentage of the butane or propane could be obtained by the process?

Cooper: Again, it is dependent upon the temperature to which you can cool the regeneration gas. To condense out the propane requires a lower temperature. But if you can cool it down to +50° F., with some methanol injection, as high as 50% propane can be recovered. A higher per cent than that of butane can be recovered.

Q. Could low temperature and short-cycle processes be used to advantage in combination?

Heumann: Very definitely. In fact, there is an increasing trend to use several of these processes in combination in order to provide an economical method of getting a higher recovery. Economically, rich-gas streams are better handled by low temperature, and lean-gas streams by the short-cycle dry desiccant. So putting one in front of the other seems to be one combination that has proven very satisfactory.

Q. Why use a closed regeneration system in the Dryex process?

Bourne: The closed system as used in the Dryex process is for the condensation of what actually is recovered. In the adsorption process, two things must be considered: the percentage adsorption and the percentage condensation. In the closed regeneration system, we can get recoveries of propane, i.e., condensation of propane, of about 65%; about 85% condensation on the butane; about 95% on the C_5's, and about 95½ on the C_6's. So the adsorption process is not just a matter of adsorbing, but a matter of condensing also. Thus we feel that is best done by the closed regeneration system.

Q. What are the liquid-recovery costs of a low-temperature separator unit as compared with a regular separator unit?

Francis: The only difference between the recovery costs in operating a low-temperature separator that utilizes the pressure available from the well to generate the refrigeration is the difference in the amount of gas that is normally flared. It is normally not economic to compress that small a quantity of gas; yet it is a quantity of gas that could otherwise have been sold to the pipeline. In one case where the gas is worth about 16 cents in the high-pressure sales line, the additional recovery costs a little more than 18 cents per barrel.

Q. What do you mean by adsorptive capacity of the desiccant, and how do you figure payout on this unit?

Cooper: The things that are factors in the recovery are adsorption capacity and condensation. Hydrocarbon adsorptive capacity of the desiccant is the ability to pick up from the vapor these recoverable fractions of natural gasoline. Each type of solid desiccant can recover a particular fraction better. Adsorptive capacity can be expressed in how many gallons of C_5-plus a pound of desiccant can hold. It can hold so much hydrocarbon or it can hold so much hydrocarbon and water vapor. Since water vapor is preferentially adsorbed, the longer the cycle, the more the water vapor will tend to displace the adsorbed hydrocarbons.

If water-vapor adsorption is limited, typical adsorptive capacity would be about 3 to 3½ gal. of hydrocarbons per 100 lb. of desiccant in each tower. Recovery is then dependent on amount of desiccant and number of cycles used.

The payout on a unit extracting 35 bbl. per day will cost installed $40,000. Price of product is about $3 a barrel; thus over a year's time, sale of the product would just about pay for the unit. This must be compared with spending $150,000 to drill a 35-bbl. per day oil well which is considered to be a pretty good one.

Q. Is there any rule-of-thumb for determining when to use ammonia-absorption refrigeration and when to use a short-cycle unit?

Heumann: We have a new short-cycle unit called Dry Frac. The first commercial unit has just been put on stream in the Louisiana area.

From 5 to 10 bbl. per million you are possibly still in the range of the short-cycle unit. But each gas should be considered separately. In recoveries of over 10 bbl. per M.M.c.f., both processes should be examined critically. The distribution of components in the gas will in many cases determine which is the most economical unit.

G. W. McCullough (Phillips Petroleum Co.): Would you convert your definition of rich and lean to gal. per M.c.f.?

Heumann: If you have 0.35 gal. per M.c.f. of iC_5-plus and you have about 5,000 gal. of total products available —from that point on up, start looking at ammonia refrigeration. The exact switchover point is a matter of economics based on the subject gas; for example, pressure, composition, distribution of components in the gas, location, and availability of water can all affect the choice of process.

Bourne: I think a combination of plants—refrigeration and adsorption —will be considered in the future, particularly if you have any appreciable volume of gas.

Francis: The market situation will affect the selection as much as anything else. In some areas purchasers insist that liquids from these units be essentially propane free. If you are interested in only the heavy ends, you have to look with great favor at the solid-desiccant units.

Q. Why use a direct-fire heater in the short-cycle process?

Bourne: It is used to obtain a temperature of 600° on the regeneration gas. This temperature is necessary to liberate the bed of hydrocarbons adsorbed, and to free the gel of any residue which would cause a decrease in activity.

The thermal efficiency of the direct-fired heater is approximately 70%. When bypassing an indirect-type heater some gas will be trapped and will approach the temperature of the heating medium, some 700° to 800° F. The gas will soak at this temperature for 15 or 20 minutes causing cracking and depositing of coke. This will result in hot spots in the coils and also stop up the bed. Gas trapped in the direct-fired heater is cooled, thus eliminating the cracking reaction.

Francis: Mr. Chairman, I want to take exception to the previous remarks. I believe you can produce a temperature of 600° using indirect-fired heater as well as you can a direct-fired heater. The terminal temperature on these towers is not any different from that in the usual solid-desiccant dehydration unit. The only reason you go to 600° is so you can drive the heat into the tower. The terminal temperature on the unit runs about 350° to 400°.

Bourne: Our temperature at the exit approaches 550° F. With a 450° temperature gas we have found that the

adsorptive capacity of the beds is decreased by 50% for the propane, 30% for the butanes, 25% for the pentanes, and 15% for the hexanes. These figures come from actual field data.

Heumann: The direct-fired heater is a fine piece of equipment at a refinery where it can be watched and where the necessary controls can be justified.

I am very much impressed by Magnolia's safety program for direct-fired heaters. Any time a major oil company goes to that much trouble and expense to protect equipment there is sound reasoning and long experience behind it.

What I wonder is how much safety equipment you can justify for unattended operations? I wonder what the possibility for ruptured tubes is going to be? I know personnel are not likely to be hurt, but you can lose your whole unit.

Bourne: We have a very sensitive rate controller which in the event of a tube failure would isolate both the hot and the cold lines from the heater.

Also, the coils closest to the flame (about 2 ft.) are made of stainless steel. We have a high inlet-shutdown controller so that if burner gas is temporarily shut off to the heater, the regenerator gas is bypassed. We have a high stack-temperature shutdown controller which does the same thing in the event a pinhole develops in the tube. We have a temperature controller on the outlet of the gas to control it to the 600°. Of course, we have the normal fuel-gas scrubbers, etc., as you do on your direct-fired heater. We feel there are more controls and much better controls on the direct-fired heater than on the salt-bath heater.

Heumann: Certainly there are many more. Salt-bath heaters do not need many controls.

Bourne: I think you will have to admit the direct-fired heater is much more efficient.

Francis: No, I think that a 350° to 450° exit temperature is high enough.

Cooper: I agree with Bourne, because we have used direct-fired heaters for 6 years using the same type of heater as Bourne described. With adequate controls and design our experience shows that the direct-fired heater can be made practically foolproof. The only failures that we experienced early with these units were due to the lack of sufficient shutoff controls and due to parallel-flow coils.

With a single-series coil as we now have, there isn't the same chance for coking up, and it isn't possible to split the flow unevenly through a given bank of coils. This would give uneven temperature and higher in some cases than our controls would sense. We feel that this is the final answer for safety in the direct-fired heater.

Q. What effect do reactivation temperatures have on desiccant life?

Cooper: We have desiccants which have been regenerated at these high temperatures in service for 2 and 3 years. These desiccants have continued to give high adsorptive capacity. At higher temperatures, heavy components are stripped out which are not at the lower temperatures.

C. Victor Bolles: (Davison Chemical Co.): Silica gel's life has not been adversely affected by these high reactivation temperatures. Cooper has stated that the same desiccant has been in service 3 years.

Q. What is the difference between an open-cycle and a closed-cycle hydrocarbon-recovery unit?

Heumann: The open type is used in the dry-desiccant units that are now designed strictly for dehydration—that is, those in which a portion of the stream has been sent through the bed which is to be regenerated. This is accomplished by imposing a pressure drop on the main stream which will allow this amount of gas to go through the bed to be regenerated.

The closed cycle takes gas essentially at its dew point, heats it up, and then, by means of a blower, pushes it through the bed to be regenerated. Since it was essentially saturated when it entered the heating cycle, what you drive off from the bed will be condensed to a very large degree after you have cooled that hot gas. Our unit in Louisiana has a blower on it with the open-cycle system as a spare so that if your blower is shut down for any maintenance purposes, you can operate on the open cycle.

Another difference which will mean most to people in the gas-transmission business is that the closed cycle can give you a unit with a very low pressure drop, something in the neighborhood of 30 psi. or less, whereas the open cycle would give the same size unit a much higher pressure drop. This means dollars to you in horsepower on your booster stations.

Francis: In the evaluation of closed cycle versus open cycle, one has to consider how much load the plant is carrying. The difference in recovery between a loaded closed cycle and a loaded open cycle is about 30%. The closed cycle is less sensitive to condensation temperature than is the open cycle. A temperature even as high as 125° affects the over-all recovery of a closed-cycle plant very little as compared to condensation temperature of 90°.

Bourne: The closed system is necessary when you are recovering lighter components such as propanes and butanes. Very little condensation will occur in the split-stream system on lighter hydrocarbons. In using the split stream, the condensation efficiency on the split stream on the heavier-type hydrocarbons is about 50 or 60%. The hydrocarbons not condensing plus the load from the main stream is then forced on the tower. Therefore, there is much greater load on the tower in the open cycle. There is lower condensation efficiency and therefore less product.

Cooper: You can expect to run into a number of mechanical problems in the closed-system unit as referred to before. With the power-driven blower, high-pressure, high-speed seal problems or high-pressure electrical-contact seals are difficult at best. With a turbine driving the blower, the close tolerances required and the damage done when solids such as hydrates hit the turbine make it a constant possible source of shutdown and repair requirements.

We recognize that there is some **slight** advantage to the condensation in a closed system. However, we more than offset that difference in the three-tower unit by the shorter cycle and the more efficient adsorbing. After all, you have to adsorb it by the desiccant bed, and a desiccant already saturated can't hold more than its saturation point.

It was mentioned that in the closed system pressure drop was less. Yes, it can be, if you supply external energy such as the electric-motor or gasoline-engine-drive blowers. But don't think that you can pull yourself up by your bootstraps and use pressure drop to drive a turbine and come out with any less pressure drop than by pinching down on a control valve.

Q. On, say, a ¼ to ½ gal. per M.c.f. of propane and heavier gas, what approximate percentage recovery of propane, butane, and pentane-plus do you get with: (1) refrigeration unit, and (2) desiccant unit?

Cooper: Both depend on how cool you can get the stream and the remaining composition of the stream. I couldn't give you at all an accurate per cent of propane you could get with refrigeration, but it is a calculated equilibrium percentage at each temperature. With the three-tower unit we could perhaps get as much as 50% of that equivalent volume.

Heumann: That is, of course, much too lean to do an adequate job with the low-temperature-type units. When

you are trying to bring down your propane on the low-temperature unit, you do need heavy ends to give that adsorptive advantage.

Q. How low can gas pressure be and still use ammonia refrigeration successfully?

Heumann: Most of the quotations we have made to date have been for pressures in excess of 300 psi. By and large, the greater percentage of these have been over 500 psi. However, on one, the gas stream was only 135 psi. and after refrigerating to 0° we condensed 62% of the total stream and knocked down 83% of the propane. In considering this type of process, recovery is a function not only of pressure but of composition. The leaner the stream, the greater pressure you are going to need to do an equivalent job with low temperature. This 135-psi. stream was extremely rich and, of course, the richer it is, the easier it is to get something out of it.

Q. Can you give any figures on the life of silica gel?

Bourne: Of course that is a problem in which everyone is very vitally interested in the use of fast-cycle units. After a year's operation, we have found that the silica gel is active to this extent: the propane and butane recovery, about 60% as active as the new bed; the pentane and heavier, about 70 to 83%; and the water about the same, 70 to 83%. That's after a year's operation. This is far superior to the conventional dehydrator where the temperatures are somewhat lower, in fact in the 300° range where the activity drops off to about one-half after just a few months' operation.

Cooper: I would like to supplement that. We have several units in service in which we have had desiccant exceeding 2 years. We have used silica gel. From a hydrocarbon-recovery standpoint, they have not lost more than 20% of their capacity. We attribute it definitely to the higher-temperature regeneration. There are other types of desiccants which may have only a year's life and, of course, that would make it very expensive. If you dropped off that much you would want to change. But when you are talking of a 20% reduction, and it doesn't show any more reduction for the next 2 years, you haven't lost much by keeping in the old desiccant.

Q. What is the minimum temperature to which a tower can be heated and get dehydration, or water removal?

Cooper: When you drive out the water, it comes off at a particular temperature and pressure, and they are related. If you don't drive off that water in one cycle and you continue to cycle the unit and do not peak at any higher temperature than that, you just never boil off the water. You load it up one time, and it loads up worse the next time. Anywhere from 220° temperature at 300 psi. up to 300° at 750 psi. is required to completely boil out the water vapor. As I already have mentioned, the heavier hydrocarbon components have to be boiled off at a higher temperature than that. The lighter components are being boiled out in advance of the water drive.

Q. Does the pressure affect the temperature to remove water? There used to be quite a controversy on pressure regeneration of these driers.

Cooper: Yes, a plot of the temperature of the boilout on water slopes up. It requires a higher temperature to boil out the water at the higher pressure.

Q. What are the liquid recovery costs of a short-cycle unit?

Francis: When you get into the short-cycle or any of these recovery processes you are usually dealing with gas that is worth anywhere from 10 to 21 cents per M.c.f. One of the things that is not often taken into consideration—and I am reemphasizing it for the sake of focusing attention on it—you have to place some value on the flare gas. I have seen some economic studies in which a value of 40 cents has been assigned to the recovery costs of a 10-M.c.f. unit recovering about 45 bbl. a day. Taking gas shrinkage into consideration, the recovery costs may run from 25 to 45 cents per barrel.

Q. Do you use cast-iron fittings in ammonia service? If so, are you able to prevent leakage?

Heumann: The only cast iron that is in the ammonia system is in the pump which is all iron fitted (that is because brass cannot be exposed to ammonia), and in the valves that are used in direct contact with ammonia. These valves are of refrigeration design, and we haven't found any better. There is a special feature on this type of valve—the fact that it is a backseating valve—a globe type that has a globe seat on the packing side as well as on the closed-off side so they operate either fully closed or fully opened.

When they are fully open they can be repacked under pressure. In essence, you not only have the packing to keep your ammonia from leaking out, but you have your seat which also prevents ammonia from leaking out.

Q. Dr. Willard M. Dow states that the desiccant must be replaced yearly. Does this indicate that the bed loses its capacity to adsorb hydrocarbons or that the desiccant is physically damaged?

Bourne: In our design, for the recoveries predicted, we downrate what new silica gel will do by some 20%. That gives us a very realistic picture throughout, we feel, at least a year's operations. After a year's operation, the actual activity of the bed on propane and butane component's adsorptive capacity ranges from 50 to 60%, and I believe the C_5's and heavier about 70 to 83%.

Q. This loss in capacity—does that mean it is physically damaged?

Bourne: I am assuming that means damages due to attrition losses. Of course there is a recommended velocity through any bed, and if you stay below those velocities I don't believe your losses due to attrition will be great. We haven't experienced it in our units, I'll say that. After a year's operation, it was taken out and screened so we could see what had happened.

Q. What is the efficiency of the two-tower unit Type 2?

Cooper: We could say that the efficiency of recovering certain components of that is the same amount as has been discussed here so far. Under certain conditions, the Type 2 unit, which is conventional flow essentially, can get in the 70-75% effective removal of C_5-plus.

The three-tower unit was designed to shorten that cycle and increase that per cent recovery by physically switching it faster and keeping the desiccant always undersaturated. We do not require any more heat—we have worked around that by using the heat that is coming from the tower cooling and pass that into the heater. It goes into the heater at the same temperature as it is coming out of the heater at some stages of the cycle. This means that instead of increasing the heat load with the Type 3 three-tower unit you are actually decreasing the amount of heat load required, and you are still accomplishing a higher per cent recovery of the C_5-plus.

Q. Assuming a well stream of about 3 M.M.c.f. per day at 2,500 psi. approximate pressure, what will be the cost of a dual installation (low temperature, followed by dry desiccant)? Can any of you give a quick figure like that? In other words, a refrigeration followed by a short-cycle plant?

Cooper: I think we can sell one for about $25,000.

EACH TRIPLE STRING is made up and run independently into hole. Then it is pulled and racked in derrick in doubles. Here crew pulls strings apart so that clamps may be applied on floor. Centralizers are used. Longest string carries a guide shoe and fillup collar.

EACH PERFORATING GUIDE must be indexed while running so that it aims the perforating gun in the right direction. Then the strings are clamped together so that the guide will always be at the same angle relative to the other strings. Guide aims perforator, based on the slot-and-key principle.

What it takes to make a

multiple, tubingless completion

RACCOON BEND field of Austin County, Texas, is the scene of some of the first multiple, tubingless completions. Operator is Humble Oil & Refining Co.

In these wells, two or three strings of 2⅞-in. o.d. pipe are cemented side-by-side in open hole. There are no single, large-diameter oil string, no tubing, and no tubing packers. In essence, each of the 2⅞-in. strings is a separate well; there is no flow path from one to the other in the christmas tree or downhole.

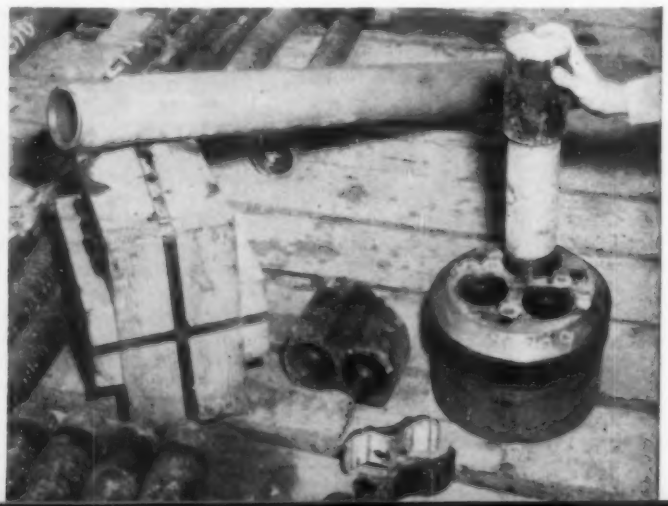
Humble estimates that such a dual tubingless completion costs only 60% as much as two conventional wells. A triple tubingless well is said to cost about 50% as much as three conventional wells.

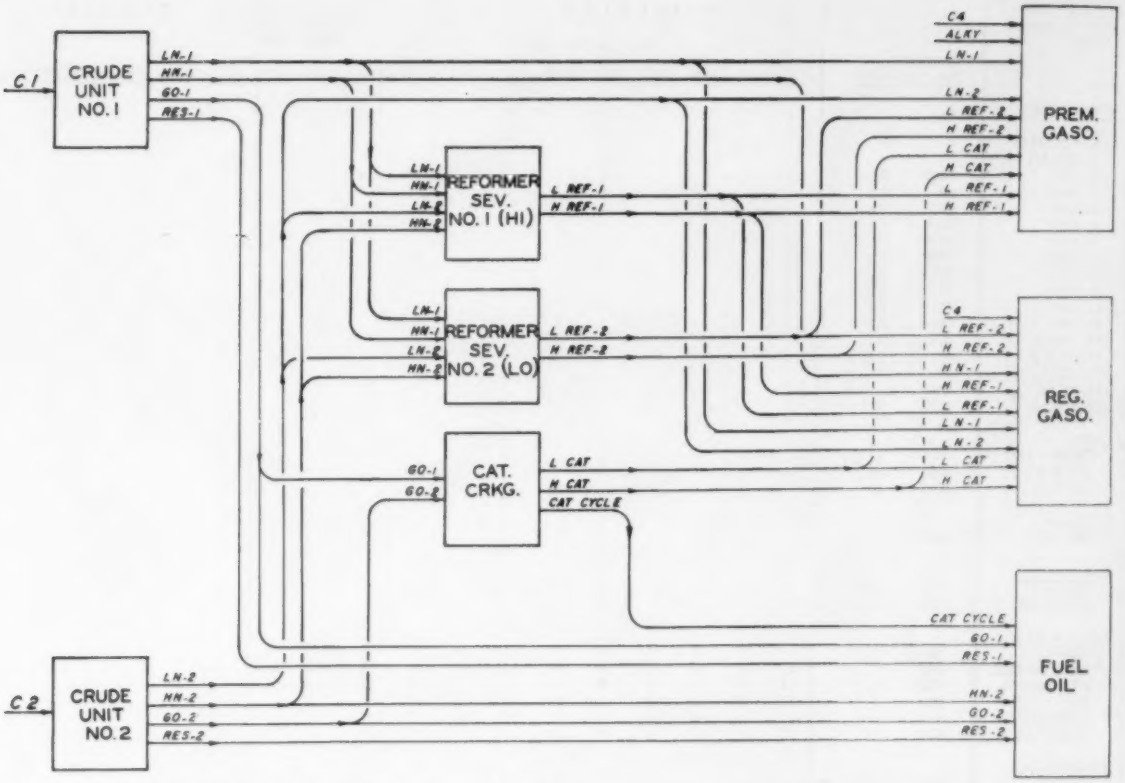
BY ED McGHEE
Drilling Editor

In anticipation of pumping the wells later, Humble hung 1¼-in. tubing inside the 2⅞-in. casing. Insert-type rod pumps will be used, on ½-in. rods. See The Oil and Gas Journal, p. 136, November 17, 1958, for a complete description of process.

LOW-COST triple wellhead is only 28 in. high from bradenhead to wing valves. In anticipation of pumping wells later, Humble has hung 1¼-in. tubing in the wells. Except for this, tubing isn't needed. The 2⅞-in. casing is identical to tubing strings in many wells.

SPECIAL EQUIPMENT includes casing hanger, at center. At center front is clamp which fastens parasite strings to tension string. Just above is the shoe used at the bottom of each parasite string. The long nipple is perforating guide, which is run immediately above each zone to be perforated.





FLOW PATTERN for hypothetical refinery for which linear-programing model is developed. Fig. 1.

How to formulate a

Linear-programing model for refinery simulation

BY CHARLES R. NICHOLS
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REFINERS are constantly faced with operating decisions. Maximum profit for the plant results only when these decisions are correct. As an example, a hypothetical refinery with its flow pattern (Fig. 1), characteristics (Tables 2-5), product requirements (Table 1), and economic factors (Table 6) is defined in this article.

The problem with which we are faced is the usual one: How should the refinery be operated in order to realize maximum profit while still meeting all requirements? More specifically, we will need to decide such things as:

- How much crude should the refinery run?
- How should this total feed rate be split between the two available crudes?
- Should alkylate be purchased for premium-gasoline blending?
- At which severity level should the reformer be operated?
- How much gas oil fresh feed should be charged to the catalytic cracker?

An extremely powerful tool in arriving at such decisions is the mathematical technique known as linear programing. The use of this tool has become practical through the development of several excellent linear-programing codes for automatic digital computers. The availability of computers and proven codes, then, leaves only one problem: the building of a "model" to adequately define the system in question and allow the computer to describe in detail the operating procedure which will result in maximum profit.

This article deals with such a procedure: the formulation of a mathematical model defining the hypothetical refinery described by Fig. 1 and Tables 1-6. The information shown concerning this refinery is only that which is required in the model.

Availability of various stocks

	Equation No.	RHS	PREMIUM 0101	0102	0103	0107	0111	0112	0113	0114	0115	0116	LEAD 1 1050	LEAD 2 1051	REGULAR 0202	0203	0204	0207	0211	0212
COMPONENTS																				
1. ALKYLATE																				
2. BUTANE																				
3. LN 1	0003	0 ≥			1											1				
4. HN 1	0004	0 ≥															1			
5. GO 1	0005	0 ≥																		
6. RES 1	0006	0 ≥																		
7. LN 2	0007	0 ≥				1												1		
8. HN 2	0008	0 ≥																		
9. GO 2	0009	0 ≥																		
10. RES 2	0010	0 ≥																		
11. LREF 1	0011	0 ≥					1												1	
12. HREF 1	0012	0 ≥						1												1
13. LREF 2	0013	0 ≥							1											
14. HREF 2	0014	0 ≥								1										
15. LCAT	0015	1.5 ≥									1									
16. HCAT	0016	1.5 ≥										1								
17. CYCLE	0017	4.5 ≤																		
CRUDE																				
CRUDE 1 RATE	4001	40 ≥																		
CRUDE 2 RATE	4002	60 ≥																		
TOTAL RATE	4003	80 ≥																		
REFORMER																				
FEED RATE	5001	20 ≥																		
CAT CRACKER																				
FEED RATE	7001	30 ≥																		
TEMP LIMIT	7003	10 ≥																		
PREMIUM GASO.																				
QUAN.	1001	10 ≤	1	1	1	1	1	1	1	1	1	1								
RSCH. KNOCK	1002	0 ≥	-4	-4	+8	+15		-4	+2	-2	+3	+9	+.8	+1.1						
MTR. KNOCK	1003	0 ≥	-12	-13	-1	+5	-2	-2			+5	+9	+.8	+1.1						
RVP	1004	0 ≥	-2.5	+60	+1	-2	-2.5	-7	-3.5	-7.5	-1.5	-6								
LEAD LIMIT 1	1052	0 ≥	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	+1							
LEAD LIMIT 2	1053	0 ≥	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		+1						
REGULAR GASO.																				
QUAN.	2001	20 ≤													1	1	1	1	1	1
RSCH. KNOCK	2002	0 ≥													-11		+8	+7	-6	-12
MTR. KNOCK	2003	0 ≥													-18	-6	+1		-6	-5
RVP	2004	0 ≥													+58	-1	-8	-4	-4.5	-9
LEAD LIMIT 1	2052	0 ≥													-1	-1	-1	-1	-1	-1
LEAD LIMIT 2	2053	0 ≥													-1	-1	-1	-1	-1	-1
FUEL OIL																				
VIS. BL. NO.	3002	0 ≥																		
PROFIT		Z MAX.=	-.50	+2	+5	+5	+5	+5	+5	+5	+5	+5	+.01	+.01	+1	+4	+4	+4	+4	+4

What it is . . . A linear-programing model is one in which a set of linear equations defines the restrictions on a system of variables. The variables are greater in number than the restricting equations so that many different solutions may satisfy the restrictions. The final solution may then be chosen on the basis of achieving maximum profit.

In building a linear-programing model, then, it must first be decided exactly which variables are of concern and what restricting equations (or inequalities) must be recognized. The variables in this case are rates of flow to the refinery units and to finished products, the severity level of the reformer, and the catalytic cracking temperature.

In order to establish a meaningful numbering code for the variables, the following system has been adopted:

1. Components have been assigned identifying numbers; e.g., alkylate is component 1.

2. Potential usages for the stocks have been categorized and each category given a number. Thus stocks into premium gasoline are numbered in the 0100 series.

3. The combination of the two above systems allows complete identification of each variable. Examples: 0102 signifies stock 2 in category 1 or butane blended into premium gasoline; 0709 identifies the quantity of gas oil_2 (component 9) fed to the catalytic cracker (category 7).

Having recognized the pertinent variables and selected a numbering system for their identification, we are now ready to formulate the equation which restricts the system.

Material Balances

The first general class of equations shown in Fig. 2 defines the availability of various stocks. Since alkylate and butane are considered to be readily available on a purchase basis, no equations for components 1 and 2 are required. Component 3, light naphtha and $Crude_1$, will have limited availability. In other words, the usage must not exceed the amount produced from $Crude_1$. Reference to Table 3 shows that the yield from $Crude_1$ is 30%, so that we may write:

$$1\,(0103) + 1\,(0203) + 1\,(0503) + 1\,(0603) \leqq 0.3\,(0431) \quad (1)$$

Where:

(0103) is the amount of LN_1 (component 3) blended into premium gasoline (category 1).

(0203) is the amount of LN_1 in regular.

(0503) is the amount of LN_1 fed through the reformer at high severity.

(0603) is the amount of LN_1 fed to the reformer at low severity.

(0431) is the amount of $Crude_1$ fed to the refinery.

for the linear-programing model. Fig. 2

REGULAR						FUEL OIL						CRUDE 1	CRUDE 2	REFORMER HI. SEV.				REFORMER LO. SEV.				CAT CRKR.		TEMP
0213	0214	0215	0216	LEAD 1 2050	LEAD 2 2051	0305	0306	0308	0309	0310	0317	0431	0432	0503	0504	0507	0508	0603	0604	0607	0608	0705	0709	7002
												-.30		1				1						
												-.25			1				1					
						1						-.20										1		
							1					-.20												
													-.17			1				1				
								1					-.25				1				1			
									1				-.30										1	
										1			-.25											
														-.60	-.10	-.50	-.05							
														-.27	-.75	-.35	-.78							
1																		-.62	-.08	-.50				
	1																	-.29	-.84	-.40	-.91			
		1																				-.25	-.20	-.20
			1																			-.15	-.10	-.20
											-1											+.55	+.70	-.50
												1												
													1											
												1	1											
														1	1	1	1	1	1	1	1			
																						1	1	
																								1
1	1	1	1																					
-4	-10	-3	+2	+.8	+1.1																			
-4	-3	+5	+6	+.8	+1.1																			
-5.5	-9.5	-3.5	-8																					
-1	-1	-1	-1	+1																				
-1	-1	-1	-1		+1																			
						-2	+5	-5	-3	+2	-3													
+4	+4	+4	+4	+.01	+.01	+2	+2	+2	+2	+2	+2	-3.2	-3.0	-.20	-.20	-.20	-.20	-.15	-.15	-.15	-.15	-.30	-.30	-.60

Rearranging Equation 1, we write:

$$1\,(0103) + 1\,(0203) + 1\,(0503) + 1\,(0603) - 0.3\,(0431) \leqq 0 \quad (1a)$$

And in detached coefficient form, we arrive at Equation 0003 of Fig. 2:

RHS	0103	0203	0503	0603	0431
0≧	1	1	1	1	−0.30

Similarly, Equations 0004 through 0010 are developed for other components obtained directly from the crude units.

The availability of products from intermediate processing units will also necessarily be limited. As an example, consider component 11, light reformate from high-severity reformer operation. Table 4 shows the yields obtained from the four possible reformer feed stocks. The amount of high-severity light reformate which may be blended into finished gasolines will be governed by the stocks making up the high-severity reformer feed.

The equation which defines this restriction is:

$$1\,(0111) + 1\,(0211) \leqq 0.60\,(0503) + 0.10\,(0504) + 0.50\,(0507) + 0.05\,(0508) \quad (2)$$

Where:

(0111) is the high-severity light reformate blended into premium gasoline.

(0211) is the amount of $LREF_1$ in regular.

(050X) is the amount of stock X fed to the reformer at high-severity operation.

Rearranging:

$$1\,(0111) + 1\,(0211) - 0.60\,(0503) - 0.10\,(0504) - 0.50\,(0507) - 0.05\,(0508) \leqq 0 \quad (2a)$$

This then corresponds to Equation 0011 of Fig. 2.

Cat cracker yields . . . Equations for the yields from catalytic cracker must take into account the fact that the unit is always operating at a full 30,000 bbl. per day reactor charge, so that fresh feed charged to the unit is backing out an equivalent amount of recycle. Another consideration is the effect of the variable reactor temperature as shown in Table 4.

Taking specifically the case of light catalytic gasoline (component 15), the yield may be defined as:

$$LCAT = (GO_1)(Y_1) + (GO_2)(Y_2) + (RECYCLE)(Y_R) + (\Delta T)(Y_T) \quad (3)$$

Where:

LCAT is the production rate of light catalytic gasoline, 1,000 bbl. per day (M.B/D).

TABLE 1—PRODUCT SPECIFICATIONS

Product—	Oct. No. Res.	Oct. No. Motor	R.v.p.	Vis. blending No.	Quantity
Premium gasoline	100 min.	90 min.	10 max.	.....	10,000 B/D min.
Regular gasoline	92 min.	85 min.	12 max.	.....	20,000 B/D min.
Fuel oil	.....	.....	.....	0 min.	.....

TABLE 2—UNIT LIMITATIONS

Unit—	Feed rate, B/D	Other
Crude$_1$, maximum	40,000	.....
Crude$_2$, maximum	60,000	.....
Total crude, maximum	80,000	.....
Reformer, maximum	20,000	.....
Cat. cracker, incl. recycle	30,000	$850 \leqq$ temp. $\leqq 950$

TABLE 3—CRUDE YIELDS
(Per cent)

Product—	Crude$_1$	Product—	Crude$_2$
Light naphtha$_1$	30	Light naphtha$_2$	17
Heavy naphtha$_1$	25	Heavy naphtha$_2$	25
Gas oil$_1$	20	Gas oil$_2$	30
Residuum$_1$	20	Residuum$_2$	25

TABLE 4—UNIT YIELDS
(Per cent)

Feed stock—	Reformer: High severity L. ref.	Reformer: High severity H. ref.	Reformer: Low severity L. ref.	Reformer: Low severity H. ref.	Cat. cracker: L. cat.	Cat. cracker: H. cat.	Cat. cracker: Cycle
Light naphtha$_1$	60	27	62	29	..	..	..
Heavy naphtha$_1$	10	75	8	84	..	..	..
Light naphtha$_2$	50	35	50	40	..	..	..
Heavy naphtha$_2$	5	78	0	91	..	..	..
Gas oil$_1$	..	..	..	..	30	20	40
Gas oil$_2$	..	..	..	..	25	15	55
Cat. crk. recycle	..	..	..	..	5	5	−15
Cat. crk. temp., bbl./10°	..	..	..	..	+200	+200	−500

TABLE 5—BLENDING QUALITIES

Stock—	Premium: Research	Premium: Motor	Premium: R.v.p.	Regular: Research	Regular: Motor	Regular: R.v.p.	Fuel oil vis. blending No.
Alkylate	104	102	7.5	...	...	...	...
Butane	104	103	70.0	103	103	70.0	...
Lt. nap.$_1$	92	91	11.0	92	91	11.0	...
Hvy. nap.$_1$	...	...	...	84	84	4.0	...
Gas oil$_1$	...	...	...	...	...	...	+2
Resid.$_1$	...	...	...	...	...	...	−5
Lt. nap.$_2$	85	85	8.0	85	85	8.0	...
Hvy. nap.$_2$	...	...	...	...	...	...	+5
Gas oil$_2$	...	...	...	...	...	...	+3
Resid.$_2$	...	...	...	...	...	...	−2
Lt. ref.$_1$	100	92	7.5	98	91	7.5	...
Hvy. ref.$_1$	104	92	3.0	104	90	3.0	...
Lt. ref.$_2$	98	90	6.5	96	89	6.5	...
Hvy. ref.$_2$	102	90	2.5	102	88	2.5	...
Lt. cat.	97	85	8.5	95	80	8.5	...
Hvy. cat.	91	81	4.0	90	79	4.0	...
Cat. cycle	...	...	...	...	...	...	+3

TABLE 6—COST AND PRICES
(Dollars per barrel)

	Cost	Return
Crude$_1$	3.20	...
Crude$_2$	3.00	...
Reformer high severity	0.20	...
Reformer low severity	0.15	...
Cat. crk. fresh feed	0.30	...
Cat. crk. temp., per 10° per bbl.	0.02	...
TEL, per 42 ml.	0.01	...
Alkylate	5.50	...
Butane	3.00	...
Premium	...	5.00
Regular	...	4.00
Fuel oil	...	2.00

GO_1 is the feed rate of gas oil from Crude$_1$ to the catalytic cracker, M.B/D.

GO_2 is the feed rate of gas oil from Crude$_2$ to the catalytic cracker, M.B/D.

ΔT is the temperature level above 850° F., in units of 10°.

Y_1 is the fractional yield of light catalytic gasoline from GO_1 feed.

Y_2 is the fractional yield of light catalytic gasoline from GO_2 feed.

Y_R is the fractional yield of light catalytic gasoline from recycle.

Y_T is the incremental yield of light catalytic gasoline from temperature increase, M.B/D per 10°.

Now, since the reactor charge is constant at 30 M.B/D, we may write:

$$\text{RECYCLE} = 30 - (GO_1) - (GO_2) \qquad (3a)$$

Substituting in Equation 3,

$$\text{LCAT} = (GO_1)(Y_1) + (GO_2)(Y_2) + [30 - (GO_1) - (GO_2)](Y_R) + (\Delta T)(Y_T) \qquad (3b)$$

Gathering terms,

$$\text{LCAT} = (GO_1)(Y_1 - Y_R) + (GO_2)(Y_2 - Y_R) + 30(Y_R) + (\Delta T)(Y_T) \qquad (3c)$$

Now from Table 4 the yield values are obtained:

$$\text{LCAT} = (GO_1)(0.25) + (GO_2)(0.20) + 30(0.05) + \Delta T(0.20) \qquad (3d)$$

Reverting to the numerical codes for the variables and considering the potential usage for light catalytic gasoline, the material-balance equation becomes:

$$1(0115) + 1(0215) \leqq 0.25(0705) + 0.20(0709) + 0.20(7002) + 1.5 \qquad (3e)$$

Rearranging and using detached coefficient notation:

RHS	0115	0215	0705	0709	7002
$1.5 \geqq$	1	1	−0.25	−0.20	−0.20

(3f)

Equation 3f then corresponds directly to Equation 0015 of Fig. 2.

The remaining quantity balance Equations 4001, 4002, 4003, 5001, 7001, 1001, and 2001 define the restrictions on unit capacities and product requirements.

Blending Qualities

With all quantity flow restrictions now incorporated into the model, attention must be turned to the quality requirements for the blended products.

Consider first the Reid vapor pres-

sure of premium gasoline. Table 1 specifies that it shall be 10.0 maximum. From Table 5 it is seen that the blending values for all stocks are available. Coefficients for the restricting equation are derived in the following manner:

1. Assume that the weighted mean R.v.p. for the final blend will equal 10.0 (specification).

2. Tabulate for each component the deviation from this mean. For example, alkylate has a blending R.v.p. of 7.5, so the deviation is 7.5 — 10.0 = — 2.5.

3. Now, in order for the final R.v.p. to meet specification, the weighted mean of these deviations must be zero. Also, for any final R.v.p. of less than the maximum of 10.0, the weighted mean will be negative.

Thus Equation 1004 of Fig. 2 is derived:

RHS	0101	0102	0103	0107	0111	0112	0113	0114	0115	0116
0≧	−2.5	+60.0	+1.0	−2.0	−2.5	−7.0	−3.5	−7.5	−1.5	−6.0

TEL Functions

The knock-rating equations are derived on exactly the same basis as the R.v.p. restriction. An additional consideration, however, is the effect of tetraethyl lead. Note that the blending octane numbers of Table 5 are at 3.0 ml./gal., so that the lead variables used here define the amount of TEL removed from the blend. For the purpose of the present example, a TEL susceptibility curve from 1.0 to 3.0 ml./gal. has been assumed.

This curve is approximated by two straight lines:

1. From 1.0 to 2.0 ml./gal., the slope is 1.1 ON/ml./gal.

2. From 2.0 to 3.0 ml./gal., the slope is 0.8 ON/ml./gal.

Now consider the knock-rating relationship in terms of the components in the blend. The deviation from specification for each component is given in terms of octane numbers, while the units for the component quantities are thousands of barrels (M.-bbl.). Thus, in the equation, when the deviations are used as coefficients for the component quantities, the resulting terms have the units of thousands of octane-barrels. The units of the TEL terms must then also be M. ON-bbl.

If each unit of the TEL variable is considered to be a 42,000-ml. quantity, then it is seen that the subtraction of one unit (42,000 ml.) of TEL from the final blend is equivalent to subtracting 1 ml./gal. from 1,000 bbl. of the product. According to the susceptibility curve previously defined, lowering the TEL concentration from 3.0 to 2.0 ml./gal. will decrease the knock rating by 0.8 ON.

Thus, the subtraction of one unit (42,000 ml.) of TEL from the blend (in the 3.0 to 2.0 range) will result in the loss of 0.8 ON × 1,000 bbl. = 0.8 M. ON-bbl. The proper coefficient then is 0.8 for the 3.0 to 2.0 ml. TEL variable in the knock-rating equation.

If the final TEL level should go below 2.0 ml./gal., however, the slope of the curve changes to 1.1 ON/ml./gal. as defined above. This fact necessitates a second TEL variable which is applicable in the 2.0 to 1.0 ml./gal. range. In addition the amount of TEL which can be removed at a slope of 0.8 must be limited.

This is the purpose of Equation 1052 of Fig. 2. It states mathematically that the number of TEL units (42,000-ml. quantities) which may be removed from the final blend at a slope of 0.8 must be equal to or less than the total quantity (M.-bbl.) of the final blend; i.e., no more than 42 ml. may be removed from each barrel of product.

It should be noted in Equations 1002, 1003, 2002, and 2003 that the signs have been changed. For example, alkylate with a research knock rating of 104 has been assigned a minus 4 as the deviation from specification. This is because the specification is a minimum and it is desirable to formulate the equation as ≦0 instead of ≧0 where possible.

Profit Equation

All restrictions on the system have now been defined. The only remaining data required for optimization of the operation are those which describe the economics. Table 6 shows all pertinent cost information. All profit coefficients shown in Fig. 2 have been divided by 1,000 in order to maintain numbers of reasonable magnitude. For example, the value of each unit (1,000 bbl.) of premium gasoline is shown as $5.00.

Since alkylate and butane (components 1 and 2) have been considered only as stocks available for purchase, their purchase prices must be subtracted from their value as components of the finished blends. Hence the value of −$0.50 for alkylate used in premium gasoline.

The cost of obtaining the other components is taken into account through the costs assigned to the crude feed and to reformer and catalytic cracking operations. The value for each refinery-produced stock blended into premium gasoline is then +$5.00.

TABLE 7
Results of Linear Program—Maximum Profit Operation

		MBBL	PCT
PREMIUM			
LN_1	0103	1.70	7.3
$LREF_2$	0113	1.33	5.6
$HREF_2$	0114	12.51	53.5
LCAT	0115	5.73	24.6
BUTANE	0102	1.77	7.6
ALKYLATE	0101	.33	1.4
		23.37	100.0
KRR = 100.0			
KRM = 90.0			
RVP = 10.0			
LEAD = 3.0			
REGULAR			
LN_1	0203	2.09	10.5
$HREF_2$	0214	4.37	21.8
LN_2	0207	8.05	40.2
HCAT	0216	3.68	18.4
BUTANE	0202	1.81	9.1
		20.00	100.0
KRR = 92.0			
KRM = 86.81			
RVP = 12.0			
LEAD = 3.0			
FUEL OIL			
HN_2	0308	.31	1.2
CYCLE	0317	9.49	38.2
RES_2	0310	15.00	60.6
		24.80	100.0
VBN = 0			
CRUDE			
$CRUDE_1$	0431	12.61	
$CRUDE_2$	0432	60.00	
		72.61	
REFORMER HIGH SEVERITY 0.0			
REFORMER LOW SEVERITY			
HN_2	0608	14.70	
LN_2	0607	2.15	
HN_1	0604	3.15	
		20.00	
CAT CRACKER			
GO_2	0709	18.00	
GO_1	0705	2.52	
RECYCLE	7001	9.48	
		30.00	
Temp. 850°			
STOCKS NOT USED			
RES_1	0006	2.52	

Note that this value assumes that the cost of 3 ml. TEL per gallon has been subtracted from the actual selling price. Consequently, use of the lead variables (subtracting TEL from the blend) results in an additional profit. Detailed reference to Table 6 will make apparent the sources of other profit coefficients shown.

TABLE 8
Relative Values of Intermediate Stocks

		Value, $/BBL	Increment,* MBBL
3.	LN_1	4.54	9.26
4.	HN_1	4.53	3.43
5.	GO_1	3.53	1.13
6.	RES_1	—0.20	
7.	LN_2	4.26	3.43
8.	HN_2	4.50	3.30
9.	GO_2	3.58	0.86
10.	RES_2	1.00	9.97
13.	$LREF_2$	5.03	6.10
14.	$HREF_2$	5.41	2.42
15.	LCAT	4.82	10.27
16.	HCAT	4.68	4.84
17.	CYCLE	3.50	0.58

*"Increment" specifies the additional amount of each component which could be used while still retaining the relative value shown.

Results

Results from the computation of the model developed here are shown in Table 7. Several joints in the solution are significant from an operating standpoint:

1. Maximum crude capacity is not utilized. $Crude_1$ is found to be unprofitable in any amount over 12,600 bbl. per day due to the high viscosity of its residuum.

2. The reformer is operated at full capacity but at low severity. It is more profitable to lead the gasolines to 3 ml./gal. than to raise the reformer severity.

3. Premium-gasoline production is more profitable than regular gasoline. Regular is produced at the minimum required rate, while premium is blended at 13,400 bbl. per day above the minimum rate.

4. Sensitivity of the gasoline blending stocks is low enough to make it profitable to "give away" motor knock rating in regular gasoline.

5. The return of fuel oil is so low that it is more profitable to throw away the residuum from $Crude_1$ than to use the cutter stock required to blend it to fuel-oil specification. Significant payout for a coker or similar unit is indicated.

6. The maximum profit which can be derived from the operation of this refinery is $4,319 per day or 5.95 cents per barrel at 72,600 bbl. per day.

Table 8 shows the relative values of intermediate streams as computed in the solution of the linear program.

These results, then, furnish an accurate economic basis for policy decisions. Thus, the basic problem has been solved: the exact operating procedure which will produce maximum profit while meeting specifications has been defined.

Four previously separated operations are integrated in

Modular control console

A NEW diesel-engine test facility at Socony Mobil Oil Co.'s Paulsboro, N. J., research and development laboratory uses a novel, "building block" modular control console to modernize and integrate at one location four previously separate operations.

Five single-cylinder diesel engines, used to measure the performance and quality of experimental lubricating products, formerly were located at four different stations. Control equipment and instrumentation were different in each case, and operators had to be trained separately for each setup, even though the engines and tests were similar.

To unify the tests into a single, integrated operation which can be controlled by a single technician, Socony Mobil engineers G. B. Myrtetus and A. W. Kees custom-designed a fully equipped central control unit. Cost of the 20-ft.-long console was held to a minimum. The control enclosure was assembled at Paulsboro quickly and simply by joining together the standard enclosures.

Completely Eliminated

With all five engines now controlled by identical equipment, much of the complexity of the previous arrangement has been eliminated. Technical procedural details which were overlooked occasionally in the former setup now are included automatically in the test assignments. Now, one operator can handle several engine tests concurrently simply by moving just a few steps to his left or right.

The modular-design concept enabled Socony Mobil designers to provide a maximum instrument panel area for five identical sets of indicators, instruments, and controls mounted in the control console. Each of the five units in the console includes a hydraulic throttle actuator, rheostat load controller, pneumatic shutoff valves, pneumatic temperature controllers, and electrical starting switches and timers. A recording potentiometer provides a record of engine temperatures and variables for review and comparison of results, and serves as a documentary record of approval runs.

Mounted conveniently over the console just above eye level are 10 inverted turrets which slope downward for maximum visual convenience. These units house five identical sets of indicators which include speed tachometers, load gages, engine and exhaust-pressure indicators, ammeters, and voltmeters.

Quickly removable front, top, and side panels facilitate removal and replacement of electronic components mounted within the console, and also simplify problems of future expansion and further modernization.

The standard modular units were furnished by Elgin Metalformers Corp., Elgin, Ill.

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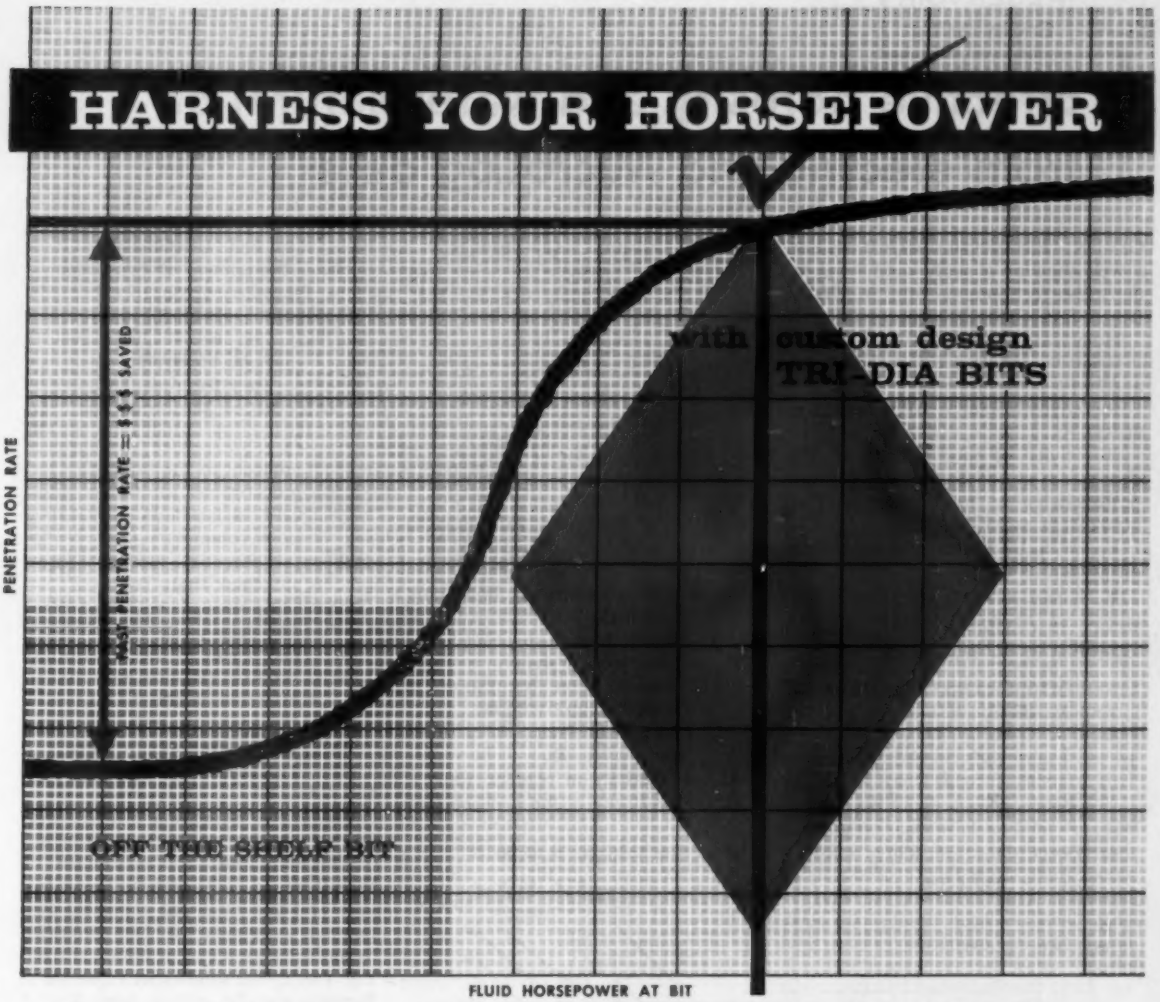

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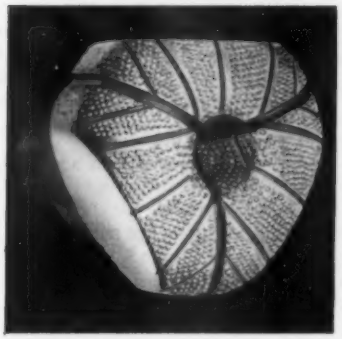

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5. Effective porosity and water saturation from electric and MicroLog data

BY E. T. GUERRERO
Head, Department of Petroleum Production Engineering, University of Tulsa
and
F. M. STEWART
Staff Engineer, Alex McCoy Associates, Inc.

GIVEN: Electric and MicroLogs for a well showing a shaly sand lying in the subsurface interval of 1,562-76 ft. Other data obtained were as follows:

Hole size, 7⅞ in.

Resistivity of mud = 0.9 ohm m²/m at 67° F.

Resistivity of mud = 0.65 ohm m²/m at 95° F.

Resistivity of mud filtrate = 0.6 ohm m²/m at 95° F.

Resistivity of mud cake = 1.45 ohm m²/m at 95° F.

$S_{xo} = S_w^{1/5}$ (from laboratory tests on numerous cores).

K = 72.

FIND: Effective porosity and water saturation of the shaly sand.

METHOD OF SOLUTION: The following equations are used:

$$\frac{1}{R_t} = \frac{p}{R_{sh}} + \frac{(1-p)\,S^2}{F R_w} \quad (1)$$

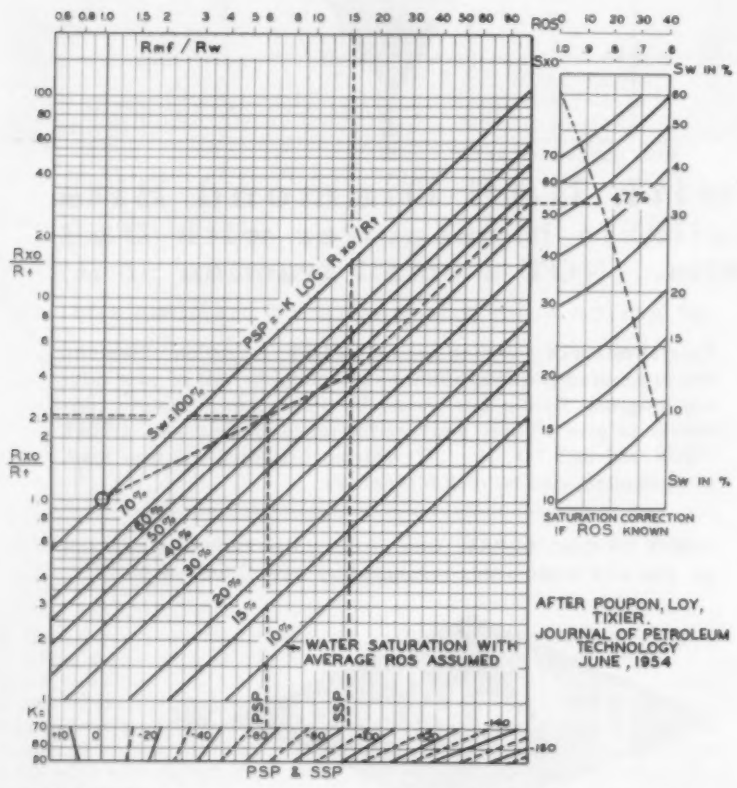
$$\frac{1}{R_{xo}} = \frac{p}{R_{sh}} + \frac{(1-p)\,S_{xo}^2}{F R_{mf}} \quad (2)$$

$$PSP = -K \log \frac{R_{xo}}{R_t} - 2\alpha K \log \frac{S_{xo}}{S} \quad (3)$$

$$F = 0.62/\phi^{2.15} \text{ (Humble formula)} \quad (4)$$

Where:

R_t = true resistivity of bulk sand and shale
p = shale, fraction of bulk
R_{sh} = resistivity of shale
S = connate-water saturation in effective pore volumes
F = formation factor of a clean sand = R_o/R_w
R_w = resistivity of connate water
R_{xo} = resistivity of the invaded zone adjacent to the borehole
S_{xo} = mud-filtrate saturation adjacent to borehole in effective pore volumes
PSP = self-potential reading opposite thick shaly bed
SSP = self-potential reading opposite thick clean bed
K = coefficient of the SP formula
α = ratio of PSP and SSP
ϕ = effective porosity
R_o = resistivity of bed fully saturated with connate water



NOMOGRAPH for determination of water saturation from log data. Fig. 1.

SOLUTION:

Fig. 1 is a nomograph which represents a rigorous solution of Equation 3. Similarly, Fig. 2 is a solution of Equations 1, 2, 3, and 4. These figures and the equations represent two possible solutions to the problem. Water saturation can be obtained from Fig. 1 or by the solution of Equation 3. Porosity can be gotten from Fig. 2 or by the simultaneous solution of the four equations. Both methods of solution will be considered.

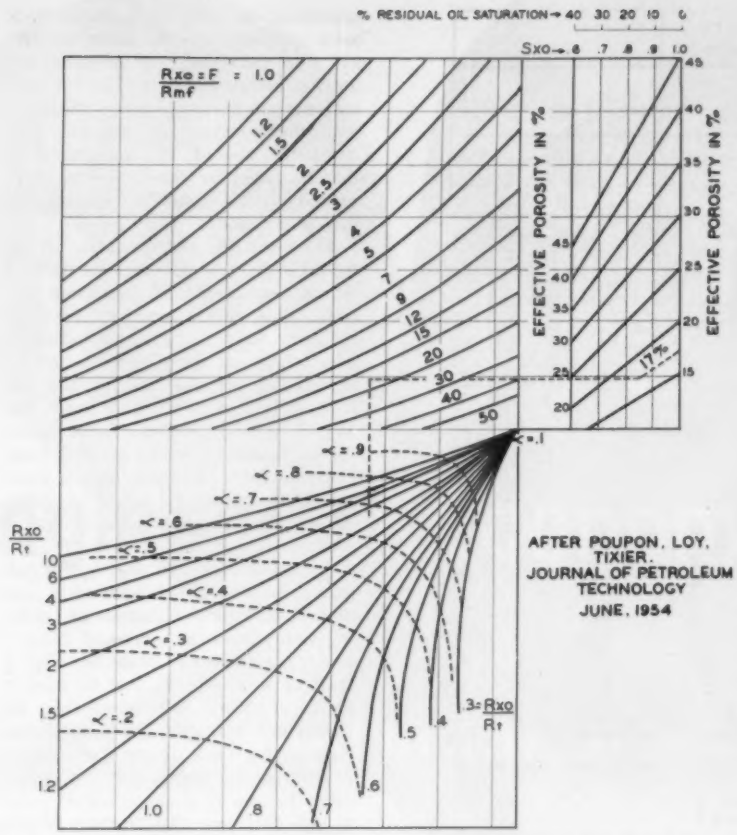
In the four equations, the unknowns are p, S, F, and ϕ. Since there is an equation for each unknown, an analytical solution is possible. Equation 3 will first be solved for the water saturation. From the two logs (Figs. 3 and 4) we obtain the following data:

PSP = −55 mv
SSP = −82 mv (from nearly clean sand)
R_t = 4 ohm m²/m
$R_{1''\times 1''}$ = 3.6 ohm m²/m
$R_{2''}$ = 4.6 ohm m²/m

$$\frac{R_{1''\times 1''}}{R_{mc}} = \frac{3.6}{1.45} = 2.5$$

$$\frac{R_{2''}}{R_{mc}} = \frac{4.6}{1.45} = 3.2$$

Using these two ratios and Fig. 2 of Part 3 of this series (OGJ, Dec. 22,



NOMOGRAPH for determination of porosity in shaly sands from log data. Fig. 2.

1958, p. 81), a value for $R_{xo}/R_{me} = 7.25$ is obtained. From this $R_{xo} = 7.25\ R_{me} = (7.25)\ (1.45) = 10.5$.

Also

$$\alpha = \frac{PSP}{SSP} = \frac{-55}{-82} = 0.67$$

Now solving Equation 3,

$$-55 = -72 \log \frac{10.5}{4}$$

$$-(2)\ (0.67)\ (72) \log \frac{S_w^{1/5}}{S_w}$$

then

$$\log \frac{1}{S_w^{4/5}} = \frac{25.0}{96.5} = 0.26$$

$$\frac{1}{S_w^{0.8}} = 1.82$$

$$S_w = 0.472, \text{ or } 47.2\%$$

Note on Fig. 1 that using $R_{xo}/R_t = 2.6$ PSP, SSP, and $S_{xo} = S_w^{1/5}$ that a value of S_w of 47% is obtained.

Equations 1, 2, and 4 will next be solved for porosity.

$$S_{xo} = (S_w)^{1/5} = (0.472)^{0.2} = 0.860$$

or 86.0%

From Fig. 1 for SSP = −82,

$$\frac{R_{mf}}{R_w} = 15 \text{ and}$$

$$R_w = \frac{(0.6)}{15} = 0.04$$

Then,

$$\frac{1}{4} = \frac{p}{3} + \frac{(1-p)\ (0.473)^2}{F\ (0.04)} \quad (1)$$

from which,

$$p = \frac{0.25\ F - 5.6}{0.33\ F - 5.6} \quad (5)$$

And,

$$\frac{1}{10.5} = \frac{p}{3} + \frac{(1-p)\ (0.86)^2}{F\ (0.6)} \quad (2)$$

from which,

$$0.095\ F = 0.33\ pF + 1.23 - 1.23\ p \quad (6)$$

Substitution of Equation 5 into 6 gives

$$0.095\ F = 0.33\ F \left(\frac{0.25\ F - 5.6}{0.33\ F - 5.6} \right) + 1.23 - 1.23 \left(\frac{0.25\ F - 5.6}{0.33\ F - 5.6} \right)$$

and,

$$F = 23.9$$

Now substituting into Equation 4 and solving for porosity,

$$23.9 = \frac{0.62}{\phi^{2.15}}$$

$$\phi = 0.183 \text{ or } 18.3\%$$

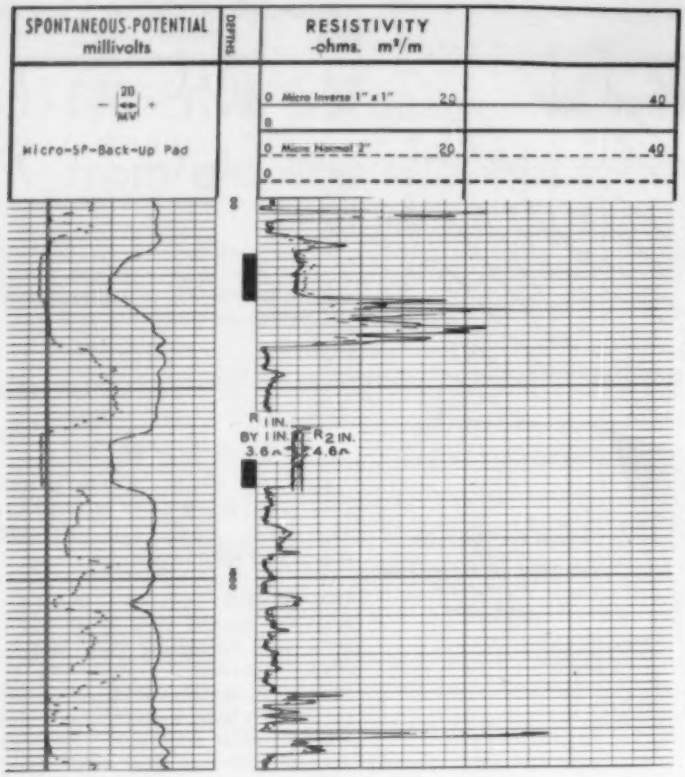
From Fig. 2, using $R_{xo}/R_t = 2.6$, $\alpha = 0.67$, $R_{xo}/R_{mf} = 10.5/0.6 = 17.5$, and $S_{xo} = 0.86$ a value of 17.0% is obtained for the porosity.

DISCUSSION: Equations 1 and 2 express the parallel flow of electricity in a sand containing shale laminations.[1] Equation 3 expresses the influence of the respective parameters involved on the self-potential obtained from a similar shaly sand.[2] Although a large number of shaly sands are of this type, there are also many that contain the shale in a dispersed state. Equations somewhat similar to the ones presented have been developed for the latter case. Many shaly sands of both a laminated and dispersed shale nature have been analyzed using both sets of equations. It was found that the porosities and water saturations obtained independently from the two sets of equations were about the same.[1] Since the equations for sands with laminated shales are more convenient to represent with nomographs, they are used more extensively.

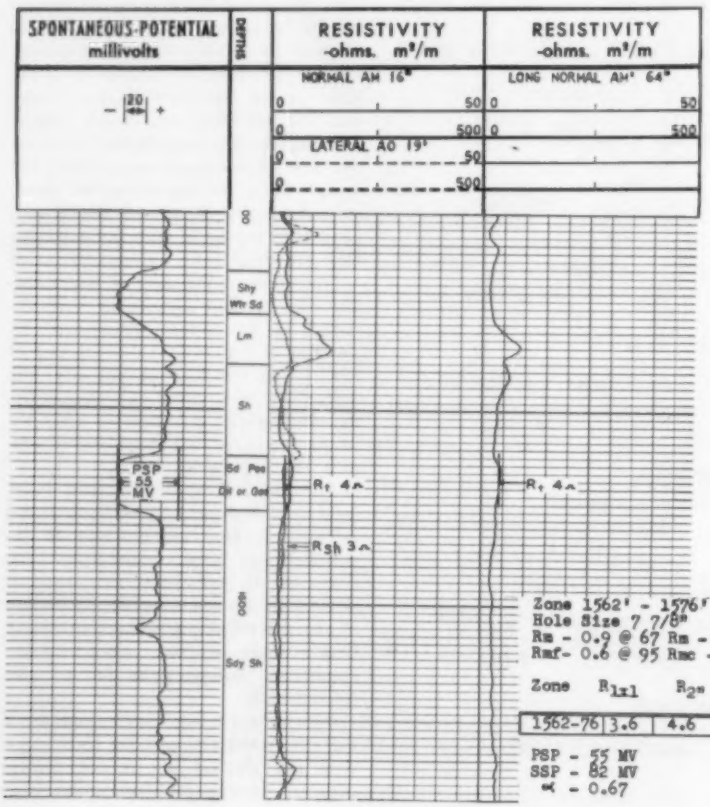
Note that in the case of water saturation excellent agreement was obtained in the values determined by solution of Equation 3 and by use of Fig. 1. In the case of porosity, the agreement was good. Consequently, the nomographs give reliable solutions of the equations and considerably simplify the approach.

This method of determining water saturation and porosity of shaly sands is relatively new and not enough experience has been obtained to fully evaluate its reliability. It depends principally on accurate determination of the electrical parameters involved. Under many borehole and formation conditions various tools fail to give reliable data.

For instance, the determination of the true resistivity of thin formations with the electric log is not always reliable. In the problem under con-



THE MICROLOG, above, and the electric log, below, are of the same shaly sand at a depth of 1,562-76 ft. Figs. 3 and 4.



Zone 1562' - 1576' e-14'
Hole Size 7 7/8"
Rm - 0.9 @ 67 Rm - 0.65 @ 95
Rmf- 0.6 @ 95 Rmc - 1.45 @ 95

Zone	R_{1x1}	$R_{2"}$	$\frac{R_{1"x1"}}{R_{mc}}$	$\frac{R_{2"}}{R_{mc}}$	$\frac{Rxo}{R_{mc}}$	Rxo	Rt
1562-76	3.6	4.6	2.5	3.2	7.25	10.5	4

PSP - 55 MV
SSP - 82 MV
α - 0.67

sideration, the sand and adjacent beds have approximately the same resistivity. And since the bulk of sand volume penetrated by the lateral and long normal devices is large compared with the borehole volume, the true resistivity should be approximately that recorded by these devices. Appreciable error could be involved in this assumption.

More reliable determination of R_t would have been possible if a focused device (induction log) had been utilized. This device tends to minimize the hole, adjacent bed, and bed-thickness effects on the true-resistivity determination. In the case of low porosities, and often in shaly sands, the MicroLog fails to give reliable values for the resistivity of the invaded zone. Consequently, for each area a careful study should be made to determine the most suitable combination of tools.

It should be noted that S_{xo} is estimated, based on flood-pot tests, and that the SSP (in the absence of known R_w data) must be obtained from a nearly clean sand. Note in Fig. 1 that the ratio R_{mf}/R_w can be used in place of SSP. Where reliable R_w values are available this ratio should be used in place of the SSP from a nearby sand. These and the many other factors that are involved point to the fact that this method should be used with care.

The advantages of this technique are many. It measures the parameters on large samples of the virgin sand from which the shale is eliminated. The results are easily obtained and the cost is low since normally the logs are run for exploration purposes. Although this method has been used sparingly in the past, it is becoming more popular. Better logging tools and techniques will certainly improve its reliability.

Acknowledgments: The authors acknowledge the assistance of W. L. Graham and E. A. Colle, Schlumberger Well Surveying Corp., Tulsa, in the preparation of the paper.

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2. Doll, H. G., "The SP Log in Shaly Sands," Trans., AIME (1950), 189, 205.

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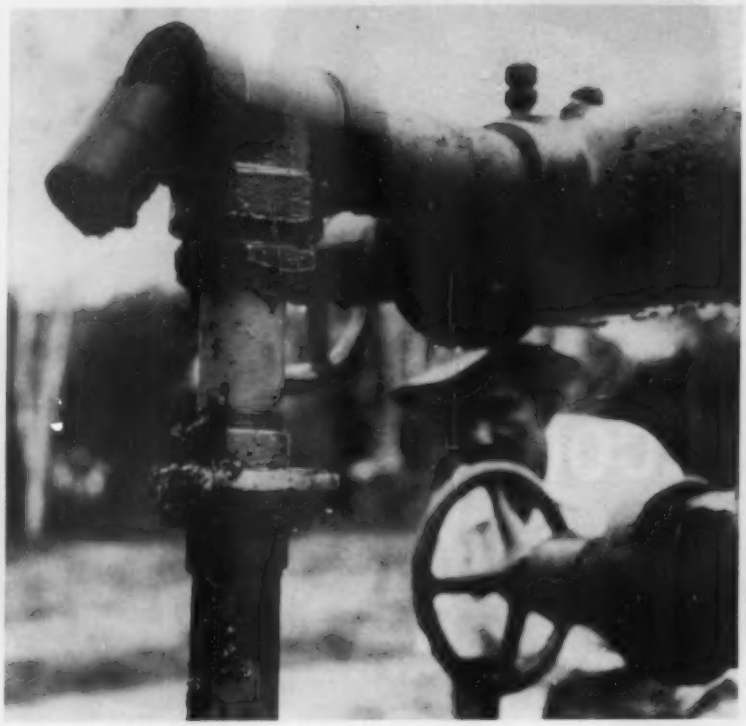


In Sumatra, Lirik crude looks like this . . .

instead of this, so . . .

Double pipelines move "solid" oil

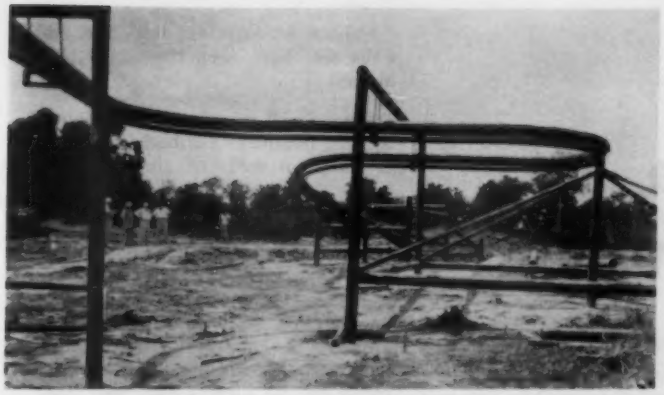
PIPELINE ENGINEER B. N. van Dieman de Jel and his Indonesian foreman discuss test results on the heated-line system with 3-in. defroster line and 8-in. crude line which are buried in contact. Hot water is pumped at 180° F. initial temperature in both directions from a station to the midpoint between stations. Both lines operate at 1,000-psi. discharge.

THE SOLID PLUG issuing from the wellhead (above left) shows what happens to crude from Sumatra's Lirik field at surface temperatures.

It will flow above 105° to 110° F. This is apparent from the photo (above right) in which oil flows freely, still retaining some subsurface heat from the reservoir which is 173° F. The trick is to keep the temperature above 105° in the pipeline, which can pump 32,000 bbl. daily.

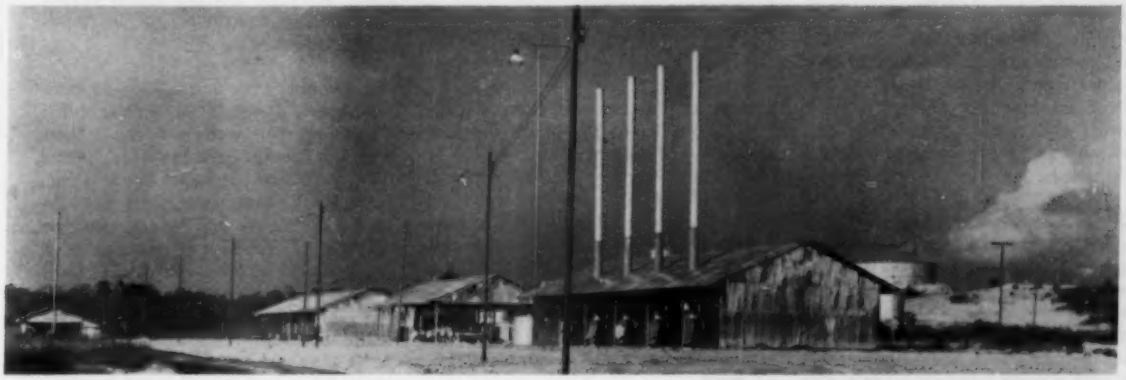
Standard Vacuum Oil Co. moves Lirik crude to a terminal on Siak River through a 90-mile 8-in. line heated by a 3-in. hot-water line (left photo). Crude is 34° API gravity with Pensky Martens flash of 84° F., vapor pressure at 100° F. of 1 psi., and viscosity ranging from about 68 cp. at 102° F. to 12 cp. at 180° F.

This method was chosen after studying these alternatives: blending with 35% of naphtha, emulsification with water, moving crude as a solid plug surrounded by water, visbreaking, and electrical heating of pipe wall or crude.



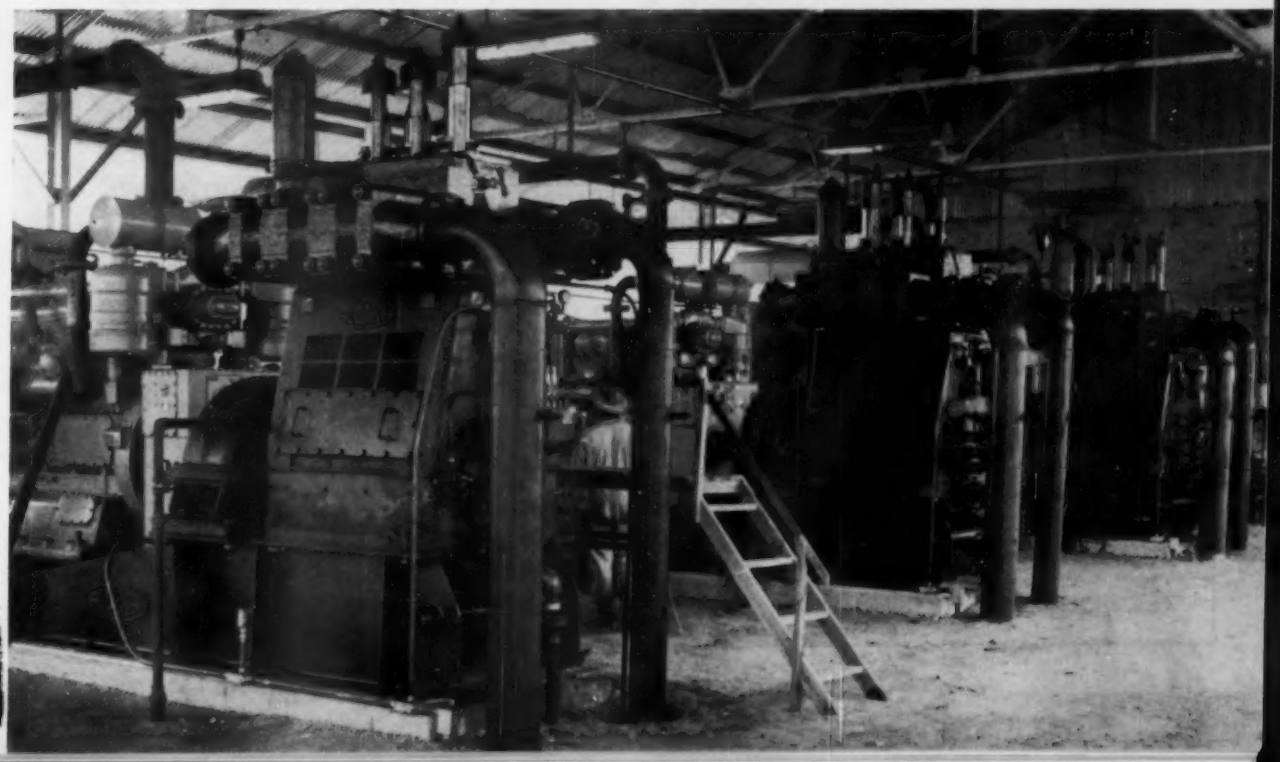
EXPANSION LOOP at Nilo River crossing is on elevated section where line crosses area subject to flooding. Lines are shown before insulation was applied. Ground temperature 2½ ft. below the surface is 83° F., several degrees below the crude pourpoint.

LINE CONTINUES underground on other side of river crossing. Preformed metal insulation covering and flood-stage debris guard have been installed.



EACH OF FIVE pump stations has four triplex pumps driven by diesel engines which burn Lirik crude, four boilers, three crude heat exchangers, and two water heaters. Pumps for defroster water are double-acting duplex type driven by diesel engines. Water is also pumped with 10 x 4 x 10 steam pumps.

THREE PUMPING UNITS (below) operate at design capacity, fourth is spare. Each pump will handle around 11,000 bbl. per day. Plungers may be enlarged to increase capacity. When units are shut down, diesel fuel is run through fuel lines and fuel pumps to prevent plugging with congealed crude oil.



Inhibitor squeeze treatment is promising

Lasting effect of chemical inhibitors applied by squeezing will save time and money. This technique is particularly important to operators of automatic leases, and to those with leases in the Canadian muskeg.

BY W. B. BLEAKLEY
Production Editor

THE NEWEST development in well-corrosion mitigation, the inhibitor squeeze, appears to be headed for widespread popularity, based on results obtained so far. Operators have reported a success ratio of better than 90%, and an average cost of $408.00 per squeeze.

Basic concepts . . . The inhibitor squeeze procedure involves the injection into the producing formation of a predetermined volume of inhibitor chosen to meet the requirements of the particular conditions. This inhibitor is pumped into the tubing under pressure and may or may not be followed by oil or water.

There are three recognized procedures:

1. Short squeeze. This is really not a squeeze job as we usually think of it because the inhibitor is simply pumped to the bottom of the well by displacing the oil in the tubing.

2. Medium squeeze. In this treatment, the inhibitor is actually injected into the producing formation. The volume of inhibitor used may vary from one job to the next, but is usually 1 to 10 bbl. Up to 50 bbl. of overflush may enter the formation.

3. Long squeeze. When the inhibitor is injected into the producing formation and followed by a large quantity of fluid to cause dispersion, the result is a long squeeze. The fluid used to "chase" the inhibitor can be either oil, distillate, or water, depending on the nature of the well. The volume of overflush used is 50 bbl. or more.

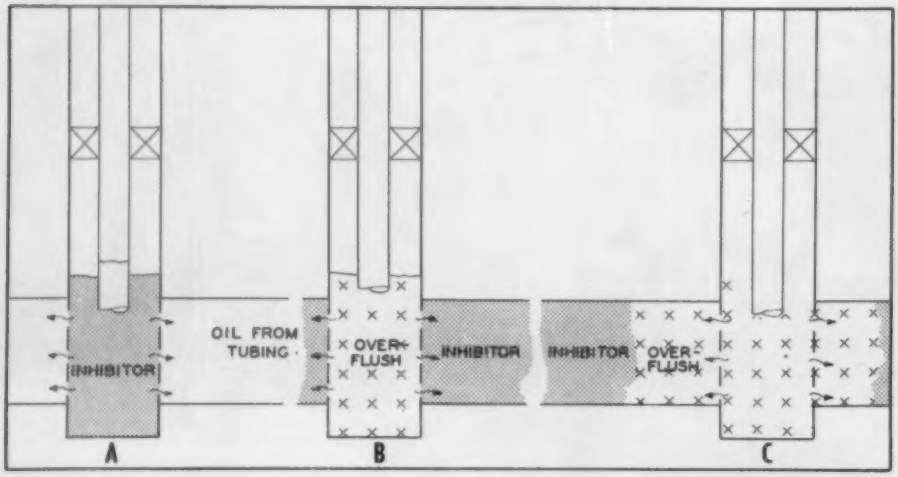
In theory, the inhibitor is adsorbed on the reservoir rock while being squeezed into the formation. As the well is produced, the fluid moving through the reservoir toward the well bore will pick up some of the inhibitor and provide a continuous supply to protect the tubing and exposed casing. The rate of desorption is less than the rate at which the inhibitor was adsorbed, so the treatment is effective for a long period of time. This is evidenced by periodic tests run on wells that have been treated by this method.

Different well types . . . The inhibitor squeeze treatment has been used successfully on wells of all types; gas wells, gas condensate wells, flowing oil wells and wells on artificial lift. Results have been gratifying in all cases, with the greatest number of tests being reported on gas and gas-condensate wells. The large number of tests on wells of this type is probably due to the fact that the inhibitor squeeze technique was originated on the Gulf Coast, and condensate-well corrosion is a real problem there.

The treatment is spreading to other areas, however, and more data should be available from wells of all types in the future.

Big advantage . . . Inhibitor squeeze treatment will last from 3 to 6 months, depending on well conditions and reservoir characteristics. This means that the usual periodic batch treatment by the pumper is not necessary, saving both time and money, and the operator is assured a steady stream of inhibitor into his well to prevent serious corrosion damage.

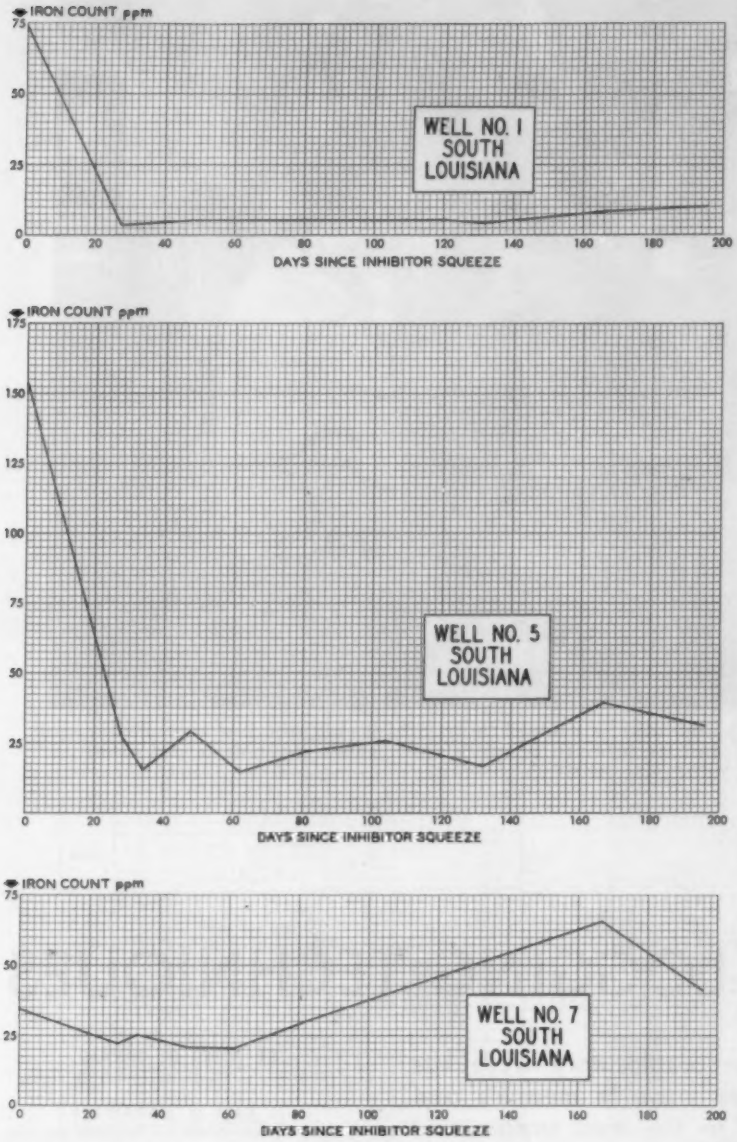
Probably the most important feature is the fact that offshore wells, onshore wells with automatic production equipment, and wells in periodically inaccessible areas can be treated when convenient, with the assurance that the well will be protected. Some Canadian wells are good examples of this type. Heavy equipment cannot be used on the muskeg except during the winter months when the terrain is frozen. A well treated in the spring will have effective protection throughout the summer months until equipment can be moved in to repeat the squeeze in the fall.



A. SHORT SQUEEZE. Mixture is pumped to bottom of well and allowed to remain in contact with tubing and casing for several hours before production is resumed.

B. MEDIUM SQUEEZE. Mixture is injected into formation. Overflush fluid can be oil, condensate, or water, and may be injected into formation in an amount up to 50 bbl.

C. LONG SQUEEZE. Mixture is injected into formation and followed by more than 50 bbl. of overflush.



EFFECT OF INHIBITOR SQUEEZE in three wells in the Gulf Coast area. All wells had shut-in pressures in excess of 3,000 psi. Injection was at the rate of 1.0 bbl. per minute, with an overflush in each case of about 30 bbl. of distillate. Total amount of fluid, chemical mixture, and overflush was 85 bbl. Success in wells 1 and 5 is shown by the decline in iron count, while the treatment in well No. 7 was a failure.

Success or failure of a squeeze treatment can be determined by the iron content of the produced fluid. It has been observed that frequently the iron content will increase immediately following treatment, but will fall off sharply if the job was successful. If the iron content fails to go below the level prior to treatment, failure is indicated. If the iron content falls off, and then returns to a high level after a few months, this is an indication that the treatment was a success, but the inhibitor has been consumed and another treatment is needed.

What they are . . . Chemically, inhibitors are a mixture of compounds derived from long-chain organic substances. These are usually derived from the fatty acids by nitrogen substitution, sometimes in the form of amines, but not always. All inhibitors are surface active.

This surface activity is one of the properties responsible for the success of the inhibitors. In order to protect the tubing and casing in the hole, the inhibitor forms a film on all exposed metal. It is preferentially adsorbed by the steel parts, to the exclusion of corrosive oil or water. Thus the protection is more a mechanical one than a chemical one; there is no chemical reaction involved in the inhibition.

Which inhibitor . . . There are two types of inhibitors available, the water-soluble and the oil-soluble ones. The term solubility is used relatively, because the actual amount of inhibitor that will go into solution is very slight.

So far, our technology is behind the applications of the inhibitor squeeze treatment, and there is no formula that can be applied to a given set of well conditions to predict which inhibitor will yield the best results. The trial and error method is the only sure one in use today.

Some reservoir rocks are subject to damage if brought in contact with water. In these cases, or in cases where the properties of the reservoir are not known, the use of an oil-soluble inhibitor is recommended. In an oil well, making water, the type of inhibitor is probably not important. Any water that is used, however, should be compatible with the reservoir.

Results . . . The accompanying graphs show results obtained from three condensate wells in South Louisiana. Others in the same field were treated, but the original iron content was not observed. Assuming that the iron content was fairly high, the results have been gratifying.

According to the graphical results, the treatment of well No. 7 was a failure. No explanation was offered for this behavior. This one failure, in comparison to the number of successes in the same field, still yields an overall success ratio close to 90%.

Recent information indicates that the short squeeze may be the most economical. Results have been good, the treatment lasts a long time, and the cost is less than the cost of a medium or long squeeze.

Precautions . . . As in other operations on expensive oil and gas wells, there are several possibilities of damage, and precautions must be taken to maintain the well on a paying status.

1. The inhibitor must not form an emulsion with the well fluids.

2. Do not force inhibitor into a low-permeability formation. Do not exceed fracture pressure.

3. Be sure that the formation is not sensitive to water when using water in mixing water-soluble inhibitors, or when using water for overflush.

4. Do not use a very adsorptive chemical in a tight formation, as it may not be produced along with the reservoir fluids.

INTERIOR of Spectra-Graph well-logging unit used on the Shell Oil Co. 5 Rumberger well. Instrumentation shown includes gas chromatograph, infrared methane analyzer, recorders, power panels, pump-stroke and counts per minute counters, and conventional hot-wire bridge meters and recorder.

What's new in

MUD-LOGGING TECHNIQUES

Drilling of more and deeper exploratory wells has developed a need for better ways to measure and identify hydrocarbon gases in the mud stream and drill cuttings. One of the new methods is called "spectrometric." Spectrometric gas analysis was successfully employed on the second-deepest well in the world, Shell Oil Co.'s 5 Rumberger in Elk City field, Beckham County, Oklahoma.

BY JOHN G. CARAN
President, Caran Engineering Corp.
and
SAM H. CARAN
President, International Exploration, Inc.

HYDROCARBON well logging or "mud logging" in its simplest form 15 or 20 years ago consisted primarily of physically examining the drill cuttings or ditch samples for taste and odor. Later, the ultraviolet or black light was used to examine these samples for the characteristic oil-type fluorescene. This made it possible to locate potentially oil-productive formations by means other than the physical senses.

The first major advance of that era was the use of an electronic gas detector or combustibles meter based on the hot-wire bridge circuit. This early instrumentation was borrowed from the mining industry where it had been used as a safety measure to detect combustible and explosive gases in mine shafts.

During the past 15 years, the hot-wire bridge was improved by increases in the sensitivity of the circuitry and reduction of the tendency of the instrumentation to record false shows, i.e., non-in situ hydrocarbons. The refined hot-wire bridge circuitry proved acceptable for logging in areas where the mud gas saturation was within the combustible limits of the detectors.

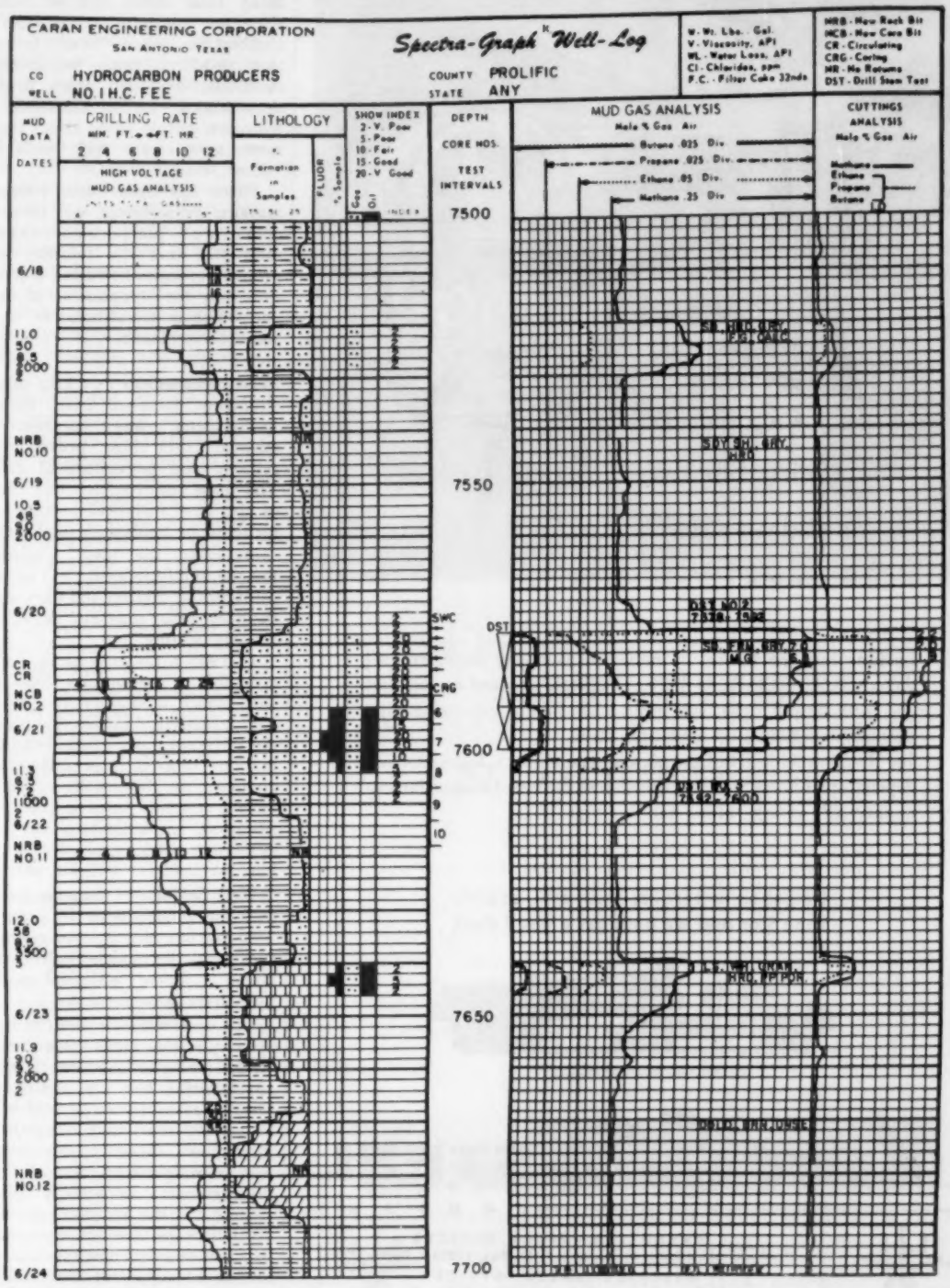
As drilling grows faster and deeper, "normal" drilling conditions rapidly have become a thing of the past. Extreme rates of penetration, either very high or very low, cause the release of formation gases into the mud stream in quantities which cannot be satisfactorily detected by the bridge. The spectrometric instruments were

developed in the attempt to properly identify and measure formation gases under all types of drilling conditions.

The companies doing this new type of logging have not standardized the equipment and methods of interpretation of the measured data. Some instrumentation developed as late as 3 years ago has already been made obsolete by new developments.

Hot-wire bridge . . . The electrical resistance of a heated platinum filament will change with an increase in temperature caused by the burning of gases on the surface of the filament. The hot-wire bridge is based on this principle. Meter readings are reported as "units" of gas. No standards for the measuring and reporting of gas units have been developed.

By the very nature of the bridge equipment it is possible for a hydrocarbon formation to be penetrated



SAMPLE PRESENTATION of spectrometrically measured mud and cuttings gases together with other pertinent well data.

Congrats and $25 for this quip to Mrs. Merlyn Goodman, Rt. 5, Box 742, Shreveport, La.

Looking into the future . . a major oil company engineer predicted 50,000 ft. wells by 1975. The world demand for oil and gas, with deeper wells, will mean a constantly increasing pipe production schedule by Lone Star Steel.
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without detection. The platinum filaments can become coated with hydrocarbon deposits making them insensitive. In some cases of deep, slow drilling with heavy muds, gas concentrations indicative of production can be above the sensing threshold of the equipment. On the other hand, many false shows can be recorded since the hot wire would burn any combustible gases. Thus, fermentation products from lost-circulation materials, hydrogen from drill-pipe deterioration, carbon monoxide, and hydrogen sulfide could affect the filament temperature and result in a "show" measurement.

There has been some success in masking or screening out these noncommercial components. However, most feel that the solution to the problem is instrumentation that measures only the components of interest and which is not affected by troublesome contaminants.

Mass spectrometer . . . Like other instruments discussed here, the mass spectrometer was borrowed and adapted from those proved by the refining and petrochemical industry. The mass spectrometer was the first of the new analytical process instruments to be applied to mud logging.

Basically, the mass spectrometer has the ability to ionize gas molecules of particular interest and then separate them by either magnetic deflection or velocity sorting.

In 1945 a research group collected a number of gas samples from drilling wells for a laboratory analysis using a large analytical model. Samples from the different types of gas-bearing formations showed large differences in composition; the results appeared to have a concrete value in source identification. Unfortunately, the massive laboratory model could not be moved into the field for well-site analyses.

First field use of the mass spectrometer was made about 10 years later. This instrument was a process monitor type using the straight deflection principle. It lacked sufficient resolution for butane measurements.

The cycloidal tube and the R. F. or velocity-sorting types were then field-tested with fair success. The mass spectrometer had one desirable feature: all measurements could be made in a fairly short time using the same instrument. However, this advantage was outweighed by several field-use disadvantages: complexity of electronics and the vacuum system; long down-time periods for instrument repair and maintenance; need for an uninterruped supply of electrical power and water. Moreover, skilled mass-spectrometer operators were needed to

"Early in 1956 this newest and most promising of all analytical techniques, the gas chromatograph, was adapted for use in the oil field."

operate the equipment and to solve the involved mathematical equations required to arrive at accurate analytical figures from the field reports.

Infrared process-type analyzers . . . The initial field infrared analyzer was tried at about the same time as the R. F. mass spectrometer. With this instrument, one gas can be measured in the presence of many others. It produces spectral sensitivity in a very narrow region of the infrared spectrum by means of the wave-length filtering characteristics of the component optical materials and gas-filled cells.

The first infrared analyzer was sensitized for methane. It proved highly successful in the measurement of this gas. To date, the methane-cell infrared analyzer is still the best method for the measurement of this gas. It produces a truly continuous record by instrumentation that is relatively trouble-free and simple.

There are several disadvantages to use of this instrument for the measurement of ethane, propane, and butane when compared to the gas chromatograph. Cost is the big disadvantage. A separate analyzer is required for each component and component measurement accuracy. Spectral overlaps of other components reduce the accuracy in measuring gases other than methane. These overlaps cause large errors when the infrared analyzer is sensitized for any of the heavier hydrocarbon gases.

Gas chromatograph . . . Early in 1956 this newest and most promising of all analytical techniques, the gas chromatograph, was adapted for use in the oil field. Basically, it has the ability to accurately analyze even trace quantities of hydrocarbons by sequential elution of successively heavier components from an absorption column. Special columns can give sensitivities of 10 p.p.m.

Either helium or air can be employed as a carrier gas. With helium gas as a carrier, a thermal-conductivity cell is used. A catalytic combustion detector, adapted during the past year to replace the thermal-conductivity cell, makes it possible to use air as a carrier gas in place of helium, which is practically unobtainable.

The instrumentation is simple and

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gives little trouble when the gas to be measured has been properly scrubbed of undesirable contaminants. The individual gases are recorded as dilution peaks in the carrier gas. Thus, the method is more adaptable for complete analyses than for monitoring methane alone.

The gas chromatograph for complete analyses combined with the infrared process-type analyzer for methane monitoring provides flexible, accurate well-site gas analyses.

Along with identifying and measuring mud and cuttings gases, the well-logging units record other data, including drilling rate, lithology, hydrocarbon-type fluorescence and saturation of samples or cuttings, bit changes, types of bits, changes in drilling-fluid composition, and mud-test results.

All of the basic information may be placed on a continuous grid. Each gas or oil show is evaluated at the well site by the engineer, thus aiding decisions as to whether to core or test. The grid can readily be correlated with electrical or radioactivity surveys.

Bottom-hole data are corrected for lag time and are shown at the correct depth.

Spectrometric mud and cuttings gas analyses are reported in mole per cent by volume in air. This eliminates any possible confusion and definition of a gas "unit." To correlate the unit with the per cent reading, a total gas curve plotted in units may also be shown as on the Spectra-Graph log.

Accuracy of the measurements depends on the quality of the gas sample. So, special gas-extraction techniques have been devised to match the high-sensitivity instrumentation.

On second-deepest . . . The combination of the infrared methane cell and gas chromatograph were used on the Shell 5 Rumberger in Oklahoma to total depth depth of 24,002 ft. Formation gas was satisfactorily analyzed even under the extremely adverse conditions of high background gas, trip gas, slow drilling, small hole diameter, high pressures and temperatures and complex hydrocarbon drilling fluids. Every 2 ft. of penetration, there was a complete gas-analysis including measurement of methane, ethane, propane, isobutane, and normal butane.

To insure accuracy and reproducibility, a program was devised to check and calibrate with standard gas mixes. More than 14,000 measurements of the methane through butane series were made using essentially the original equipment. Only changes were replacement of column materials in the chromatograph because of aging.

Fractionation-type processes—operating costs

BY W. L. NELSON
Technical Editor and Petroleum Consultant

IN THE OPERATING cost of distillation or separation of hydrocarbons or narrow-boiling-range solvents, amount of reflux is an important factor, although capacity is also an important variable. Pressure, as in debutanizers or depropanizers, is not of great significance unless the feed is in the form of a gas which must be compressed into the system. Compression is not contemplated herein. Ordinarily, all heat is introduced by means of a reboiler, although very large plants may employ a pipe-still heater for the feed and recirculating reboiler oil. Steam-heated reboilers are contemplated here. The use of a pipe still somewhat increases the cost of the plant (maintenance) and the operating labor (about one man per shift) but these increases are just about matched by a decrease in the cost of heat.

The cost of a single-tower and multitower fractionator plant was discussed on the Questions on Technology page of The Oil and Gas Journal (June 9, 1958, p. 133) and per barrel costs were indicated in Process Costimating No. 32 (Nov. 17, 1958, p. 187). If several towers are used in series (each of the full 4,000-bbl. per day capacity studied here) the cost of labor and maintenance for each tower will decrease moderately from the costs shown in Table 1 but, of course, the total cost will be the sum of the costs of operating each tower. If, however, the several towers handle only a total of 4,000 bbl. per day (the basis of Table 1) separating it into several products, the cost of both maintenance and labor will increase.

Atmospheric pressure rerunning and steam distillation operations were discussed in Process Costimating No. 32 (Nov. 17, 1958, p. 187).

Installments of Process Costimating Which Pertain to Operating Costs of Distillation-Type Processes

No. 26—September 15, 1958, p. 244—Shift Labor
No. 28—October 6, 1958, p. 218—Process Operating Labor
No. 29—October 13, 1958, p. 114—Maintenance of Process Units
No. 30—November 3, 1958, p. 88—Heat Required—Process Units
No. 31—November 10, 1958, p. 148—Process Steam—Atmospheric Distillation
No. 32—November 17, 1958, p. 187—Atmospheric Rerunning
No. 33—December 1, 1958, p. 115—Process Steam—Vacuum Units
No. 34—December 8, 1958, p. 93—Cost of Ejector Steam
No. 35—December 15, 1958, p. 108—Vacuum Flashing
No. 36—December 29, 1958, p. 145—Power—Process Units
No. 37—January 12, 1959, p. 98—Optimum Vacuum
No. 38—January 19, 1959, p. 107—Water for Distillation Processes
No. 39—January 26, 1959, p. 221—Vacuum Distillation
No. 40—February 2, 1959—Fractionation-Type Processes

TABLE 1—APPROXIMATE OPERATING COSTS FOR 4,000-BBL. PER DAY SINGLE-TOWER HYDROCARBON FRACTIONATION PLANTS

	Unit (somewhat standard)	1956 unit cost	Ref. ratio = 2 Debutanizer or solvent fractionator	Ref. ratio = 4 Depropanizer or solvent fractionator	Ref. ratio = 16 Deisopentanizer (45 plates)
Labor	0.9-1.75 men per 8-hr. shift	$3.12 per hour	1.9-3.3	1.9-3.3	2.4-4.1*
Supervision	0.1-0.25 men per 8-hr. shift	$3.85 per hour	0.2-0.6	0.2-0.6	0.2-0.6
Maintenance	3-4% per year	$55 per daily bbl.	0.4-0.6	.....	.....
	3-4% per year	$78 per daily bbl.	.....	0.6-1.0	.....
	3-4% per year	$195 per daily bbl.	.....	.....	1.6-2.1
Steam heat†	58 lb. per bbl.	45-60 ct./1,000 lb.	2.6-3.5	.....	.....
	85 lb. per bbl.	45-60 ct./1,000 lb.	.....	3.8-5.1	.....
	244 lb. per bbl.	45-60 ct./1,000 lb.	.....	.....	11.0-14.6
Power‡	0.001-0.005 b.hp./bbl.	21.6 ct./day for 1 hp.	0.02-0.11	.....	.....
	0.0015-0.006 b.hp./bbl.	21.6 ct./day for 1 hp.	.....	0.03-0.13	.....
	0.0035-0.008 b.hp./bbl.	21.6 ct./day for 1 hp.	.....	.....	0.08-0.17
Cooling water	192 gal. per bbl.	1.7 ct./1,000 gal.	0.33	.....	.....
	280 gal. per bbl.	1.7 ct./1,000 gal.	.....	0.48	.....
	806 gal. per bbl.	1.7 ct./1,000 gal.	.....	.....	1.37
Direct operating cost (probable extremes)			6-8	8-9.5	16-21

*Extra labor or wages for great height. †Somewhat cheaper if hot oil rather than steam is used for reboiler heat. ‡Range occurs primarily because feed is sometimes pumped into high pressure towers.

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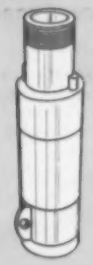

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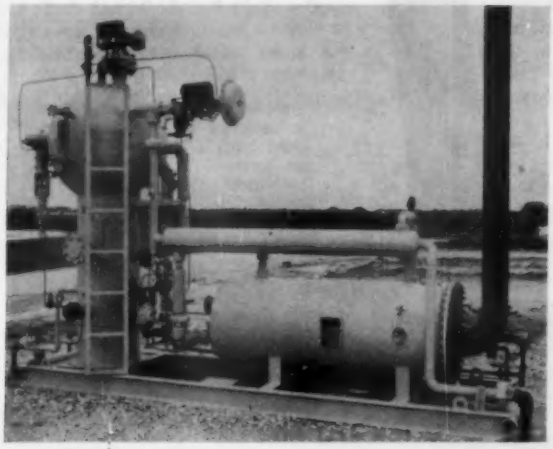
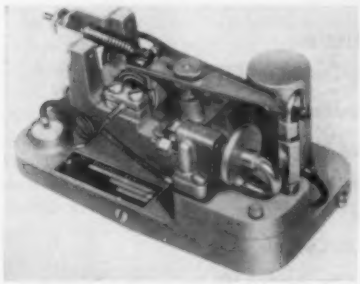


Packaged gas-distillate separator

. . . for high-ratio wells uses steam from a steam generator to heat separated liquids and allow separation under low, hydrate-forming temperatures for increased distillate-recovery rates. A thermostat controls steam flow to the heating coils. It allows automatic compensation for production-rate or climate changes.

Steam also is supplied to heating coils in a second-stage separator to keep liquid produced warm and so speed separation of distillate and water. Steam also is used in a well-stream preheater to regulate the well-stream inlet temperature to the first-stage separator. The preheater is also thermostat-controlled. An indirect line heater upsteam of the R-Tic-Cycle separation unit is seldom needed.

Operation of the unit is simple. Well production is warmed in a heat exchanger and then choked into the spherical first-stage separator. Gas leaves the separator partially dehydrated. Liquids are heated by steam-fed coils in the bottom of the sphere and the hydrates are melted. They then flow into the integral low-pressure three-phase flash separator underneath the sphere. Next they are separated into distillates and water and discharged separately. **Write or call: Union Tank Div., Butler Mfg. Co., P. O. Box 8444, Houston 4, for details on R-Tic-Cycle separation system.**



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. . . into proportional pressure. The temperature transmitter is for measurement in the range from −30° to 1,200° F. Unaffected by normal plant vibration, it is sturdy and compact unit having few moving parts.

A thumb-screw adjustment can be set over a wide range. Additional range limits and operational spans can be established in the field by substituting different precalibrated thermal systems. No other changes are needed.

The Sensaire transmitter has an unusually small bulb. It is fitted with a universal type of mounting bracket that permits installation almost anywhere on flat surfaces, pipelines, well-wrench heads, pipe hangers, or separable bushings with various degrees of rotation.

Actuation is by a mercury-filled thermal system. The base is made of die-cast aluminum fitted with an aluminum cover to make a weatherproof housing. Calibration accuracy is 1% of range below and 1½% above 550° F. **Write or call: Taylor Instrument Companies, 95 Ames Street, Rochester 1, N. Y., for details on Sensaire temperature transmitter.**

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Level indicator gives fast check

. . . of any number of tanks remotely. Operations for a tank farm or a process can be supervised from a central station by using one or more of the instruments connected to the tanks through a selector switch. Thus an operator can anticipate trouble due to liquid level and take immediate action.

Attached to a tank by a pipe plug, the sensing element is basically a pressure-operated resistance network that operates in the pressure range of 0 to 3,000 psi. It operates on less than 6 volts a.c.

Pressure or liquid depth is measured by the voltage across the variable sector of the network. The sector element is available as an explosion-proof unit, though the liquid does not contact the network.

The remote indicator contains a matching network, stepdown transformer, and sensitive meter calibrated in desired units. Accuracy of the level indicator is set at ±5%. Ranges are available for depths of 0-3, 0-30, and 0-60 ft. of water. **Write or call: Torresdale Co., 7844 Montgomery Avenue, Elkins Park, Philadelphia 17, for details on liquid-level indicator.**

●

Electronic computer does two jobs

. . . at the same time. The Honeywell 800 computer can do both data-processing and computation simultaneously. This ability, called automatic parallel processing, is combined with a building-block expansion principle of design to allow for expansion as needed.

The system can perform up to eight separate, independent jobs at the same time. This is accomplished with two electronic innovations—traffic control and multiprogram control.

Traffic control allows the central processor to communicate simultaneously with up to eight input and output devices, such as punch-card readers, printers, or magnetic tape units.

Multiprogram control permits the system to divide itself into as many as eight separate computers.

Basic speeds of the system include a maximum input or output rate of 96,000 decimal digits a second on each magnetic tape. Internal transfer rate is 2,000,000 decimal digits a second. **Write or call: Minneapolis-Honeywell Regulator Co., 4494 Wayne Avenue, Philadelphia, for details on Honeywell 800 computer.**

●

Direct-reading automatic tank gage

. . . comes in two models for vertical or horizontal dial reading. The Fig. 268V unit has a vertical reading dial; the Fig. 268H, horizontal. The gages are designed for use on small above or underground tanks with diameters of 5 to 15 ft.

A direct linkage between the float and dial indicator gives sturdiness to the assembly and a rugged float-to-float-arm connection. A multiadjust-

COOLING TOWER INSTALLATION

In the typical cooling tower installation shown above, the motor — outside the humid or corrosive atmosphere — is connected by a floating-shaft coupling to the gear box under the large slow-speed, horizontal-blade fan.

REFINERS! PIPE LINE MEN! DRILLING ENGINEERS! LABORATORY TECHNICIANS!

Thomas Couplings are used to advantage on Pumps, Compressors, Cooling Towers, Rigs or any other tough job where continuous operation and dependability are required.

Future maintenance costs and shutdowns are eliminated when you install Thomas Flexible Couplings.

Under Load and Misalignment only Thomas Flexible Couplings offer all these advantages:

1 Freedom from Backlash Torsional Rigidity
2 Free End Float
3 Smooth Continuous Drive with Constant Rotational Velocity
4 Visual Inspection While in Operation
5 Original Balance for Life
6 No Lubrication
7 No Wearing Parts
8 No Maintenance

THE THOMAS PRINCIPLE GUARANTEES PERFECT BALANCE UNDER ALL CONDITIONS OF MISALIGNMENT

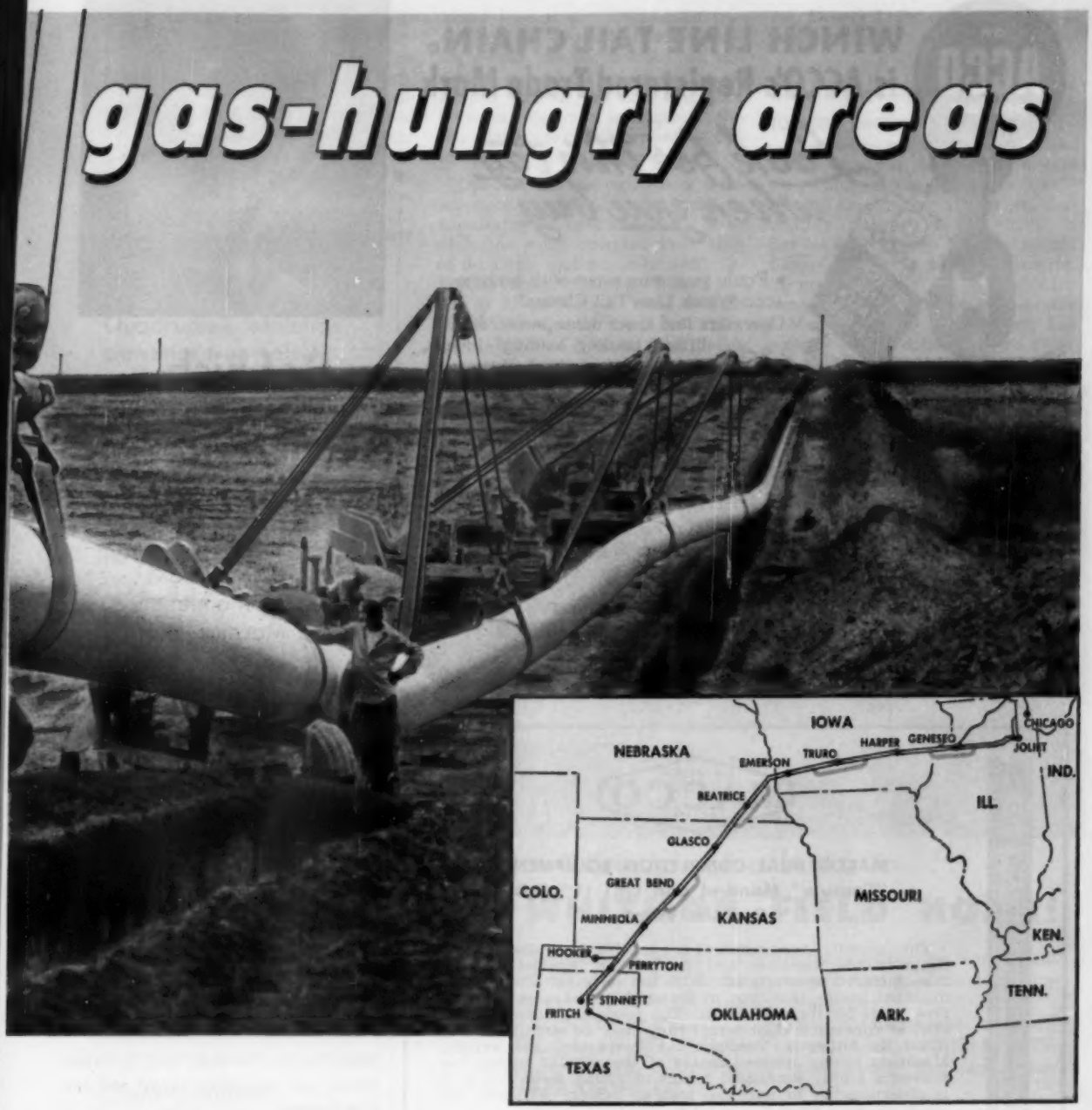
Write for Engineering Catalog 51A

THOMAS FLEXIBLE COUPLING COMPANY
WARREN, PENNSYLVANIA, U.S.A.

Natural Gas Pipe Line Company of America completes 513 miles of looping line in record time

Additional supplies of natural gas from the Panhandle and north-central areas of Texas will soon flow through new lines, and initial deliveries to the Iowa, Illinois, Wisconsin and Indiana markets will be increased by 100 million cubic feet per day. Nearly five hundred miles of 36" pipe and twenty miles of 26" pipe have been laid . . . will bring new gas supplies to the midwestern markets. In furnishing a little more than half this pipe, A. O. Smith Corporation is proud to have helped serve Natural Gas Pipe Line Company of America and its tremendous markets.

gas-hungry areas



For 30 years . . .

A. O. Smith line pipe has always been manufactured to a high standard of quality . . . precisely controlled at every step of production. That's why A. O. Smith pipe made and installed in 1928 is still in operation. That's why so much A. O. Smith pipe has been used on so many important pipeline projects.

Through research . . . a better way

A.O.Smith

CORPORATION

TUBULAR PRODUCTS DIVISION

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an ACCO product

WINCH LINE TAIL CHAIN® is ACCO's Registered Trade Mark

Look for this tag when you buy

• Equip your wire ropes with genuine ACCO Winch Line Tail Chains.* Operators find them unsurpassed for lifting, hauling, loading—in fact, for exacting work of all types.

• The tag reproduced here is attached to every new ACCO Winch Line Tail Chain.* It is your assurance of highest quality, long chain life and dependable performance.

Write our York, Pa., office for **Bulletin DH-1021.**

*Reg. U.S. Pat. Off.

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AMERICAN CHAIN & CABLE

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Better Value

TIME TESTED
MACCO
GAS LIFT

MACCO DUAL COMPLETION EQUIPMENT
"Capsule" Mandrel and CM1 (1" O.D.)
Gas Lift Valve

The "capsule" type mandrel is available from stock for all standard dual, macaroni, and slim-hole lift. Special sizes are manufactured upon request. With the valve and check valve mounted inside, this type of mandrel provides extra large flow areas for the well fluids. The producing zones of parallel or concentric dual completions may be simultaneously lifted by either a "common" or "separate" gas supply. Macaroni tubing lowered inside of the regular tubing has proved a highly successful means of lifting wells where it is objectionable to pull the regular tubing. Efficient lift inside of small liners is also made possible.

The Macco fluid operated valve is particularly suited for dual completion lifting. A typical installation consists of separate, parallel strings of tubing, each equipped with Macco fluid operated valves mounted in capsule mandrels. The fluid of each zone controls the opening and closing of its valves. The casing annulus serves as the gas supply for each string of valves. Valve interference is eliminated and each zone is lifted independently of the other. No surface equipment other than a choke in the gas input line is needed.

Macco manufactures many different types of dual completion equipment to fit any well requirement. For further information, write for Brochures No. 3-12, 3-21, and 3-31.

MACCO OIL TOOL COMPANY, INC.

1521 Prince — P. O. Box 7288 — Houston 8, Texas
Phone UN 1-1253

. . . Refinish Crank-Pins . . . In Place!

● Accurate High Quality Maintenance And Machine Work

The small engine crank pictured above was restored in close quarters without dismantling engine. Our portable machines can solve your problems and save you money. Crank pins from 5½" through 20" in diameter accurately refinished in place at great saving in cost. Let us help you minimize down time.

Worn and damaged flywheel fits refinished in place.

In our shop crankshafts of any size or type completely refinished. Shafts straightened and broken shafts successfully repaired.

Most modern methods used in rebabbitting and machining engine and turbine bearings.

All types of heavy power plant equipment serviced with special attention given to emergency repairs.

Additional information furnished without obligation.

WASHINGTON
IRON WORKS, INC.
SHERMAN, TEXAS
Established 1876

Pho. TW—2-8145

ment on the linkage makes installation and calibration easy.

The dials are plastic. A sight glass mounted in a weatherproof seal protects the dials. Tank vapors are restricted from entering the gage head by a positive seal. A dehydrating agent eliminates condensation. Installation of the gage can be made through a 3-in. coupling. **Write or call: Vapory Recovery Systems Co., Compton, Calif., for details on Figs. 268V and 268H tank gages.**

●

Quadruple-completion christmas-tree valve

. . . is now available with four 2-in. through-conduit gate valves in a single body. The valve comes in the 2-in. size with up to 5,000-psi. API maximum working pressure.

The multiple-completion valve uses pressure-seal bonnets, parallel expanding gates, closed packing boxes, and precisely finished stems. **Write or call: W-K-M Div., ACF Industries, Inc., Box 2117, Houston, for details on quadruple-completion christmas-tree valve.**

●

More-uniform torque demand on . . .

Crank-balanced oil-well pump unit

. . . as compared to older types has been achieved by placing the speed reducer on the well side of the samson post and using a propeller type of crank which lifts the front of the walking beam, according to the maker. Thus the Mark II pump is expected to permit use of a smaller speed reducer and prime mover for a particular well than was possible with older types.

It is also designed to give a smooth polished-rod motion.

One man can adjust the pump-stroke length easily and quickly. The motor base is a pivot-mounted type designed for long V-belt life by keeping proper and constant the belt tension. A natural-gas volume tank is an integral part of the skid base. The horsehead alignment jacks permit precise adjustment to compensate for mill tolerance in the walking beam.

Optional for the pump is a semi-automatic counterbalance that permits adjustment by movement of a lever while the pump operates. Four sizes of the pump unit are to be available. Torque ratings will range from 114,000 to 320,000 lb.-in. **Write or call: Oilfield Equipment Corp. of Colorado, 1730 First National Bank Building, Denver 2, for details on Mark II pump unit.**

●

Sealing compound to stop leaks

. . . around large-diameter threads and coarse fittings is compounded to take temperatures from —350° to 2,987° F. and pressures to 50,000 psi. (hydraulic). Called Led-Plate 250F, it can be used to stop leaks in welded flanges that have become distorted, the maker claims. It is also suitable for cleanout plugs. **Write or call: Armite Laboratories, 6609 Broad Street, Los Angeles 1, for details on Led-Plate.**

Nice to come home to . . .

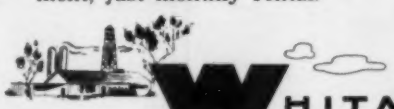
A WHITMOR FIELD HOME!

Your employees want a home that's attractive, convenient and individual — not makeshift housing. And good field housing will attract and keep top quality employees.

Across the continent . . . even in isolated areas . . . you'll find distinctive WHITMOR field homes. And you'll find WHITMOR homes give you more for your money than any other housing on the market.

Whether you want a few houses or a complete small town with all utilities, streets, recreational building, swimming pool and tennis courts . . . WHITMOR can handle all your housing problems on one purchase order. Thirty-six years experience in homebuilding assures your complete satisfaction.

Investigate WHITMOR's unique "Lease-Rental Plan", which gives you the use of field homes without capital investment, just monthly rental.



WHITMOR HOMEBUILDERS INC.

INDUSTRIAL HOUSING

BOX 5037 • TULSA, OKLA.

Turbine meter measures gases

. . . contaminated with particles to an accuracy of ± 0.5% of reading and with a low pressure drop. The new gas flowmeter operates over a wide temperature range to precisely measure gases contaminated with solid particles such as pipe scale, organic sludge, and other troublesome materials that can seriously affect gas measurement.

The meter measures volumetric throughput. Gas flow spins the turbine type of rotor. The rotor generates in an externally mounted pickup coil a pulse with a frequency directly proportional to the flow rate. The resulting data can be converted to mass flow rate or cubic feet per minute by the maker's pressure-temperature electronic computing instruments or other devices. **Write or call: Potter-meter Co., Div. of Potter Aeronautical Corp., Union, N. J., for details on meter for contaminated gases.**

●

Kit eases test of drilling mud

. . . and contains complete equipment for making the usual chemical and physical tests of drilling mud. Components include: (1) a mud balance with three scales, (2) stopwatch with cover, (3) plastic viscosity funnel, (4) all necessary reagents, and (5) a filter press for determining water loss and for study of wall-building properties.

Constructed of heavy-gage metal to take rough handling in the field, the test kit measures 27 by 19 by 12 in. and weighs only 65 lb. Its hinged front door opens to provide a convenient working surface for conducting mud tests. **Write or call: Magnet Cove Barium Corp., P. O. Box 6504, Houston 5, for details on Rig Lab.**

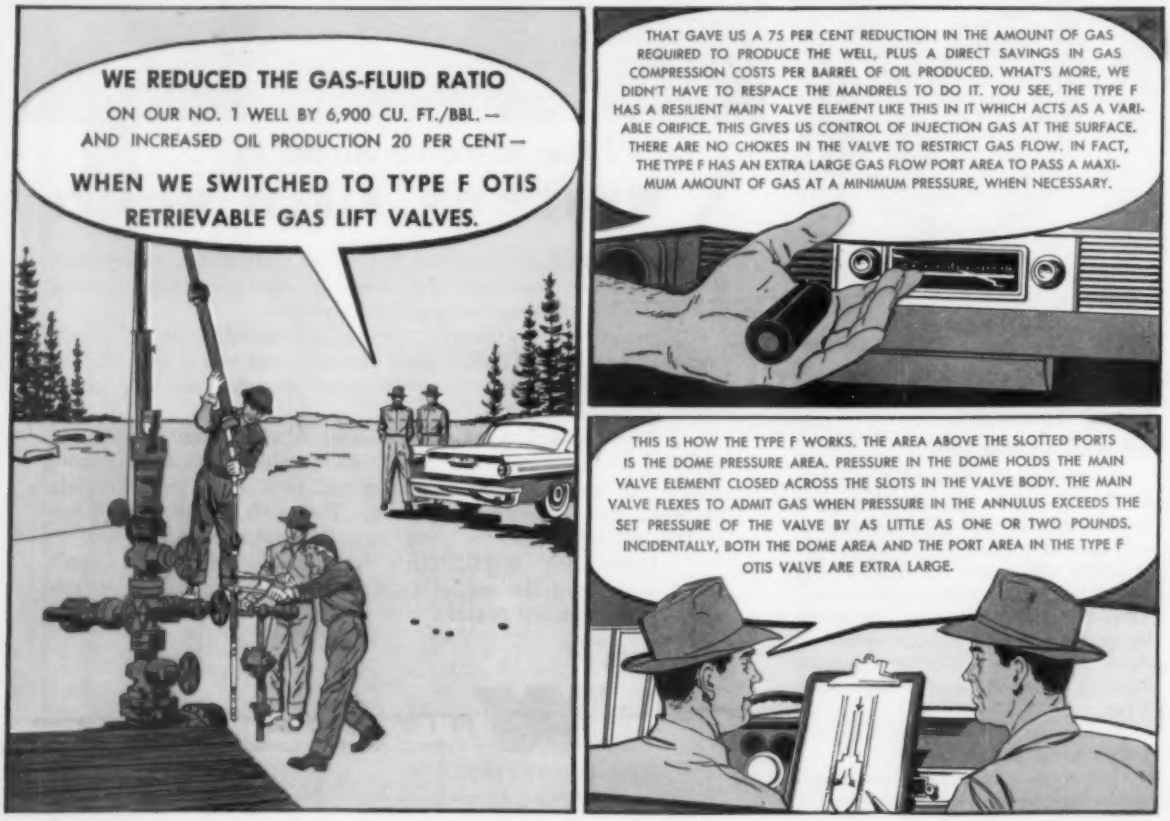
●

Electronic data-processing system

. . . the IBM 7090, gives computing speeds of up to five times those of its predecessor, the IBM 709. To achieve the fast speed, the maker has used transistors within the central processing unit of the computer. Potential applications for the unit include inventory control, production control, payrolls, and general accounting.

The computer system can perform 210,000 additions or subtractions a second. More than 32,000 ten-digit numbers can be stored in its magnetic core memory.

Each unit of the computer consists of modular sliding frames with two vertical pull-out racks. The system's data multiplexor allows it to read, write, and compute at the same time. **Write or call: International Business Machines Corp., Data Processing Div., 112 East Post Road, White Plains, N. Y., for details on 7090 data processing system.**


WE REDUCED THE GAS-FLUID RATIO
ON OUR NO. 1 WELL BY 6,900 CU. FT./BBL. —
AND INCREASED OIL PRODUCTION 20 PER CENT —
WHEN WE SWITCHED TO TYPE F OTIS RETRIEVABLE GAS LIFT VALVES.
THAT GAVE US A 75 PER CENT REDUCTION IN THE AMOUNT OF GAS REQUIRED TO PRODUCE THE WELL, PLUS A DIRECT SAVINGS IN GAS COMPRESSION COSTS PER BARREL OF OIL PRODUCED. WHAT'S MORE, WE DIDN'T HAVE TO RESPACE THE MANDRELS TO DO IT. YOU SEE, THE TYPE F HAS A RESILIENT MAIN VALVE ELEMENT LIKE THIS IN IT WHICH ACTS AS A VARIABLE ORIFICE. THIS GIVES US CONTROL OF INJECTION GAS AT THE SURFACE. THERE ARE NO CHOKES IN THE VALVE TO RESTRICT GAS FLOW. IN FACT, THE TYPE F HAS AN EXTRA LARGE GAS FLOW PORT AREA TO PASS A MAXIMUM AMOUNT OF GAS AT A MINIMUM PRESSURE, WHEN NECESSARY.
THIS IS HOW THE TYPE F WORKS. THE AREA ABOVE THE SLOTTED PORTS IS THE DOME PRESSURE AREA. PRESSURE IN THE DOME HOLDS THE MAIN VALVE ELEMENT CLOSED ACROSS THE SLOTS IN THE VALVE BODY. THE MAIN VALVE FLEXES TO ADMIT GAS WHEN PRESSURE IN THE ANNULUS EXCEEDS THE SET PRESSURE OF THE VALVE BY AS LITTLE AS ONE OR TWO POUNDS. INCIDENTALLY, BOTH THE DOME AREA AND THE PORT AREA IN THE TYPE F OTIS VALVE ARE EXTRA LARGE.

Chromatograph simplifies analyses

... through the use of three interchangeable detectors and two liquid-injection systems that permit the use of two columns without a manifold. The detectors include an argon ionization gage and either filament or thermistor thermal conductivity type of detectors.

A recorder makes a record of essential operating data such as operating current to the thermal conductivity bridge, column temperature, and temperature of the liquid-sample introduction point. A polarity reversing switch is provided to permit recording of negative peaks and of chromatograms resulting from the use of the second column.

Columns of 50 ft. and longer can be accommodated with the Series 9580 Chromacon. Its column compartment can be operated from room temperature to 300° C. Weighing 200 lb., the instrument measures 23 by 18 by 39 in. **Write or call: Podbielniak, Inc., 341 East Ohio Street, Chicago 11, for details on Series 9580 Chromacon.**

•

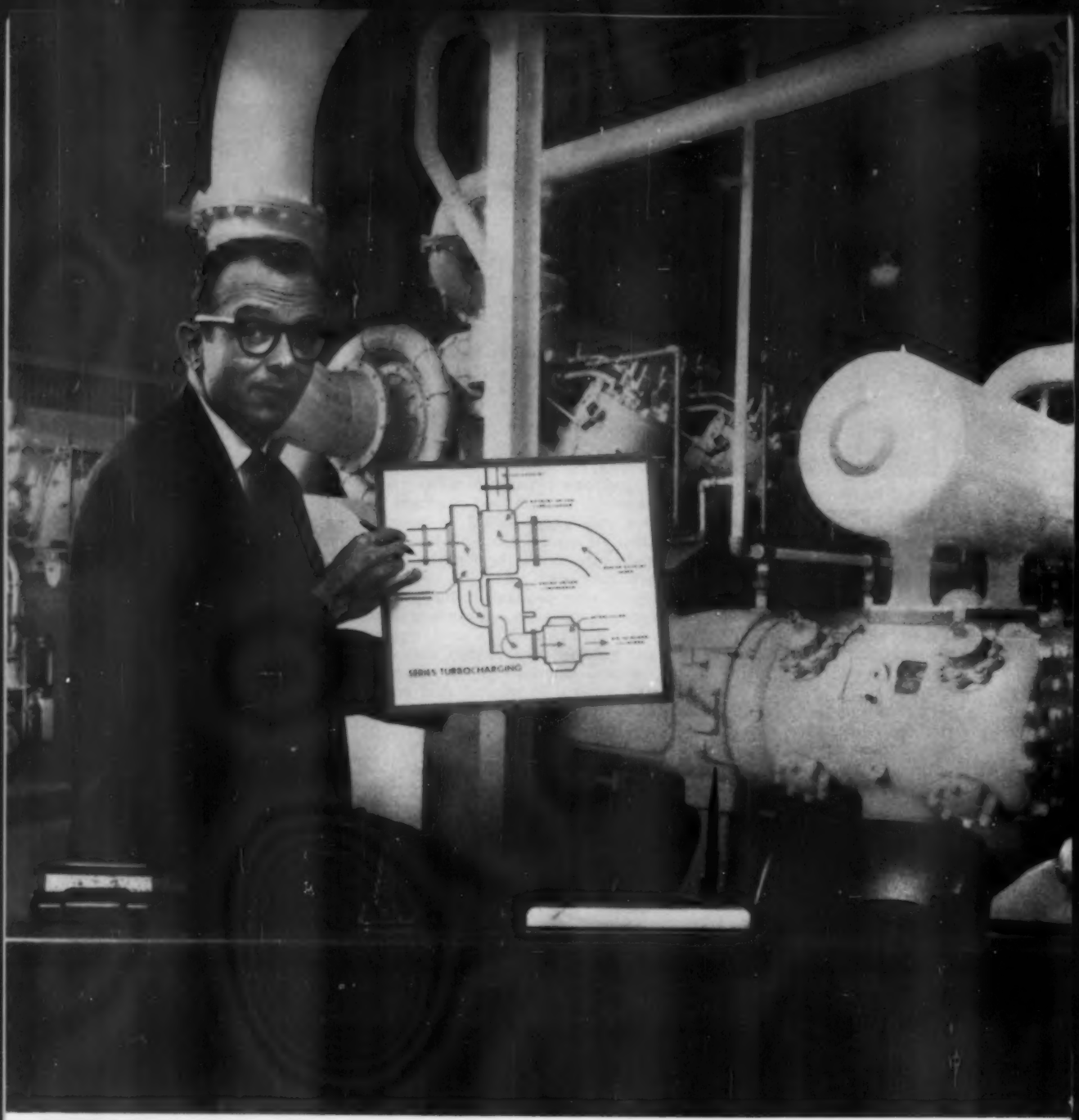
Heavy-end aluminum pipe

... promises reduced handling costs. Increased strength and thickness at pipe ends where welded or threaded joints are made while using less metal in the pipe body is the objective of the new heavy-end pipe. The inside diameter stays constant. It thus permits operating pressures equivalent to those of standard pipe with reduced shipping and handling costs. Lighter than conventional aluminum pipe, it is presently offered in selected sizes equivalent to many standard Schedule 40 and 80 sizes.

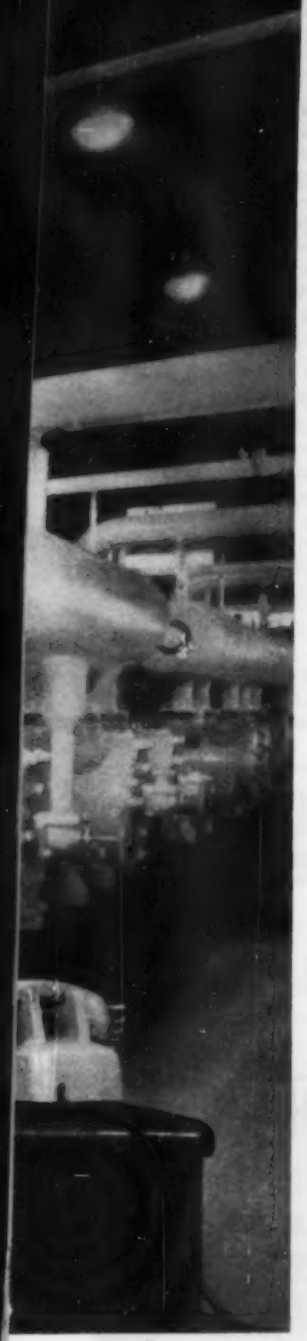
The pipe is produced by a new extrusion process that is flexible and can be adapted to a wide range of pipe diameters and wall thicknesses required for individual installations.

Ends of the heavy-end pipe are identical to those of standard pipe and are adaptable to grooving, threading, beveling for welding, and preparation for other types of mechanical fittings. Standard flanges and fittings can also be used with the pipe. **Write or call: Reynolds Metals Co., Richmond 18, Va., for details on heavy-end aluminum pipe.**

GAS ENTERS THROUGH THE PORTS, PASSES THROUGH A FINNED RETAINER, ACROSS THE RESILIENT CHECK VALVE (WHICH IS NORMALLY CLOSED), AND OUT THE BOTTOM OF THE VALVE. BECAUSE OF THE DESIGN, THE VALVES HAVE BUT ONE OPENING AND CLOSING PRESSURE — THAT'S THE PRE-SET PRESSURE.
ONE REASON TYPE F SERIES OTIS VALVES ARE SO EFFICIENT IS BECAUSE OF THE CHECK VALVE. AS I SAID, IT'S NORMALLY CLOSED — DOESN'T REQUIRE VELOCITY TO CLOSE; OPENS ONLY TO PASS THE SYSTEM GAS DURING INJECTION; GIVES A BUBBLE-TIGHT SEAL EVEN IN SAND-LADEN FLUIDS, AND ELIMINATES VALVE WASH-OUT.
THERE ARE MANY OTHER ADVANTAGES IN USING OTIS RETRIEVABLE GAS LIFT VALVES. THEY HAVE NO MOVING METAL PARTS, NO METAL BELLOWS TO FATIGUE, NO METAL-TO-METAL SEAL NOR STEM AND SEAT TO WEAR AND CUT OUT, AND YOU DON'T HAVE TO RETRIEVE OR MODIFY THE VALVES TO CHANGE FROM CONTINUOUS TO INTERMITTENT LIFT, OR VICE VERSA.
IF YOU HAVE M OR K SERIES ECCENTRIC SIDE-POCKET MANDRELS IN YOUR WELLS, AND YOU'RE LOOKING FOR WAYS TO IMPROVE THE EFFICIENCY OF YOUR GAS LIFT INSTALLATIONS, YOU SHOULD RUN TYPE F OR FK OTIS RETRIEVABLE GAS LIFT VALVES. YOU'LL GET BETTER CONTROL OF YOUR GAS — AT THE SURFACE, WHERE YOU WANT IT — WHICH CAN MEAN A LOWER LIFTING COST. GIVE YOUR WELLS A NEW LIFT — RUN OTIS GAS LIFT VALVES.
OTIS — "First in Gas Lift Control"
OTIS
OTIS ENGINEERING CORPORATION
General Offices: 5512 Denton Drive · Dallas
Branches Throughout the Oil Country



Built Entirely By Cooper-Bessemer. Cooper-Bessemer is able to ideally integrate turbocharger system and compressor engine performance . . . and to assure highest standards of materials and workmanship for these precision components.



Donald L. Reed, *Manager Gas Engine Compressor Sales, The Cooper-Bessemer Corporation, explains . . .*

How you get 40% more power with the latest Cooper-Bessemer V-Angle Compressors

The diagram explains Cooper-Bessemer's series turbocharging development. A step beyond ordinary turbocharging, *series turbocharging* assures an extra performance margin throughout the operating range, plus these unmatched advantages:

40% greater horsepower than predecessors of the same bore, stroke and speed.

Reduced fuel consumption . . . as low as 6900 Btu/bhp/hr—proof of series turbocharging's greater efficiency.

Space savings. Greater output, combined with inherent compactness of V-angle design, results in lowest cost per horsepower for housing, foundation, piping, maintenance, supervision.

Superior altitude performance. Inherent flexibility of the series turbocharging system allows unique altitude compensation to assure full rated horsepower and highest efficiency.

Full range response. The Cooper-Bessemer series turbocharging principle *automatically* provides optimum supercharging regardless of the degree of load.

WRITE FOR BULLETINS . . . complete details on Cooper-Bessemer Series Turbocharged V-Angle Compressors in GMVC Bulletin 85 and GMWC Bulletin 86. Free on request.

Latest Bulletins. GMVC Bulletin 85, 1100 to 1800 bhp; GMWC Bulletin 86, 2000 to 3500 bhp.

BRANCH OFFICES: Grove City • New York • Chicago • Washington • San Francisco Los Angeles • Houston • Dallas • Odessa • Pampa • Greggton • Seattle • Tulsa • St. Louis • Kansas City • Minneapolis • New Orleans • Shreveport • Casper

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GENERAL OFFICES: MOUNT VERNON, OHIO

ENGINES: GAS - DIESEL - GAS-DIESEL
COMPRESSORS: RECIPROCATING AND CENTRIFUGAL, ENGINE OR MOTOR DRIVEN

WHERE IS THIS DRILLING MUD?

A fraction of a second ago it was part of an overload in a mud line on a drilling rig in Texas. But destructive pressure overloads are no problem when Cameron Shear-Relief Valves like the one above are on the job. That's why this scene could have taken place in any drilling area of the free world. With the Cameron Shear-Relief Valve a common nail (U. S. Standard) takes the punishment instead of expensive pumps, manifolds and other mud line equipment. Fluid contacts the valve's piston, and when desired pressure is exceeded the piston stem shears the nail. It's as simple as that and what's more, you don't have to know if the nail is 60 penny or 16. A handy nail gauge is part of the name plate. Any rig hand can make a correct setting in seconds. When this valve opens it opens all the way. A safety cap holds the clipped nail until another is inserted. If you are making up a mud system, why not COUNT ON CAMERON Shear-Relief Valves for built-in safety and economy—almost everyone does.

Cameron
IRON WORKS, Inc.
P. O. Box 1212-Houston, Texas
Export Office: 7912 Empire State Bldg., New York City. In England: Cameron Iron Works Ltd., 26 Grosvenor St., London W. 1, England

SHOWCASE . . .

New Literature

Fuel-burning system

. . . bulletin lists 11 sizes of oil, gas, and combination gas-oil burners for firing boilers or other heat-exchange equipment. Cutaway burner views show the principles of operation resulting in clean, complete burning of various grades of fuel. The bulletin illustrates typical burner arrangements. **Write or call: Orr & Sembower, Inc., P. O. Box 1138, Reading, Pa., for Bulletin 1255.**

Lubricating-oil packaging

. . . by use of the high-speed Votator Filler for continuous, automatic product flow is described in new Bulletin PED-259. It lists unit operating speeds as high as 10 one-quart containers per second, the rate varying with product viscosity, fill temperature, and container design. A wide range of applications is described in the bulletin. **Write or call: Girdler Process Equipment Div., Chemetron Corp., 222 East Broadway, Louisville 1, Ky., for Bulletin PED-259.**

Clarifiers and thickeners

. . . for handling liquid-solids separation are detailed in new 16-page Bulletin W-800. It includes several variations in both large and small installations. The bulletin offers three types of skimming mechanisms and illustrates typical low, medium, and high-torque drives. **Write or call: Infilco, Inc., 901 South Campbell Avenue, Tucson, Ariz., for Bulletin W-800.**

Cast-alloy reference chart

. . . gives composition and physical data on 55 of the most widely used cast alloys in the carbon, low alloy, and stainless-steel groups, together with nickel and monel. The chart also contains design applications of each. **Write or call: Lebanon Steel Foundry, 129 Lehman Street, Lebanon, Pa., for cast-alloy reference chart.**

Rotary vacuum dryers

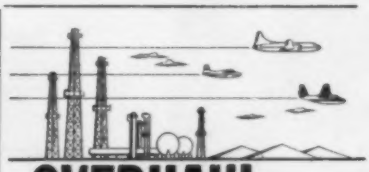
. . . are described in new four-page Bulletin 610. The bulletin describes the dryers' major design features as (1) double-spiral agitators which insure maximum drying action by continuously mixing and braiding the material; (2) spring-loaded scrapers which prevent buildup and product decomposition; (3) zoned heating and cooling for accurate process control; (4) leakproof O-ring seals on the end plates; (5) chevron-type shaft seals for low friction loss and minimum maintenance; (6) quick-opening discharge assembly; and (7) efficient dust-catching systems. The bulletin also lists practical working-volume capacities, heating-surface areas, dimensions, and weights of eight standard dryer models. **Write or call: Vacuum Equipment Div., F. J. Stokes Corp., 5500 Tabor Road, Philadelphia 20, for Bulletin 610.**

Wire-rope inspection plan

. . . designed to increase service life is detailed in new Bulletin 104. It explains and illustrates when inspections should start, how often they should be made, how they should be reported, and gives a point-by-point check list of things that should be done each time an inspection is held. The importance of equipment inspections is emphasized together with information concerning evaluation of the findings. **Write or call: Leschen Wire Rope Div., H. K. Porter Co., Inc., 2727 Hamilton, St. Louis 12, for Bulletin 104.**

Punched-card programing

. . . and punched-tape devices are detailed in new four-page Bulletin 100. The bulletin offers description data,



OVERHAUL & REPAIR

HEADQUARTERS FOR AIRPLANES

Experienced aircraft and engine craftsmen, armed with the best and latest tools and testing equipment, speed your work through modern shops with care and precision. We do everything from repairing a door handle to rebuilding air frames and engines. A complete line of spares and accessories eliminate delay. We are now serving oil companies and private aircraft owners throughout the U. S. and in many foreign countries.

DOWNTOWN Airpark INCORPORATED
1701 S. WESTERN MElrose 4-1456 OKLA CITY

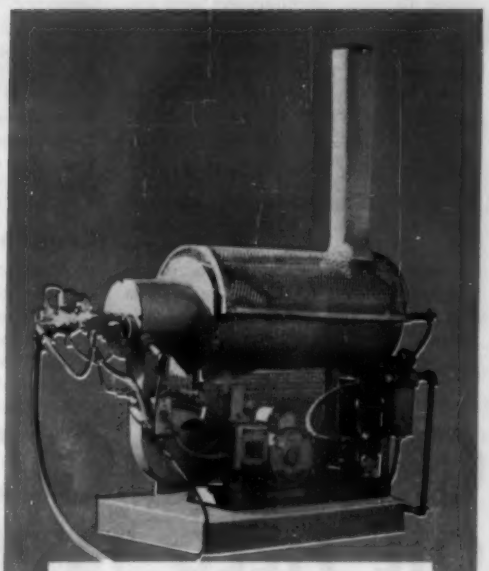
TEXSTEAM "BTU" PROVIDES

Downhole Heat Simply, Efficiently, Economically

The Texsteam "BTU" Unit is the simplest, most efficient, economical means of providing downhole heat.

The Bottomhole Thermal Heater may be used in conjunction with a surface heat exchanger and a subsurface heat exchanger connected by closed-circuit macaroni tubing. The bottomhole heat exchanger can be installed at any depth in the tubing so heat may be applied at any depth for the removal and prevention of asphalt and paraffin block . . . the reduction of viscosity . . . the elimination of paraffin or asphalt deposits in the tubing . . . the prevention of freezing in gas wells.

The "BTU" Heater is a proved Texsteam design, single coil type, unitized on a skid assembly with prime mover, circulating pump and blower. It has 300,000 BTU per hour capacity . . . maximum outlet temperature of heat transfer oil is 500 deg. F. The heater is fully automatic, fired with natural gas, or No. 2 diesel oil. Furnished with electric or gas-gasoline prime mover.



Wherever you need downhole heat specify Texsteam "BTU" Bottomhole Thermal Heater Unit for safe, dependable, economical operation. Write for Bulletin 576-BTU for detailed information specifications, etc.

TXT TEXSTEAM Corporation

A SUBSIDIARY OF VAPOR HEATING CORPORATION

320 HUGHES ST. • P .O. BOX 9127, HOUSTON 11, TEXAS • PHONE WA 6-8853

TWO BUILDINGS—15,000 SQUARE FEET FOR SALE OR LEASE IN ODESSA, TEXAS

Buildings located on south side of East 2nd St. (HWY 80) at corner of Dixie Blvd. (a truck route & perimeter road); on land leased from the Texas & Pacific Railroad; 200' front on E. 2nd St. and 330' deep.
Land lease is $575.00 annually (paid thru July 1959).
City, School, County & State Taxes are about $450.00 annually on Buildings.

1010 East 2nd Street

This is 1 & 2 story PARKERSBURG ALL METAL BUILDING with ORNAMENTAL STONE FRONT, CONCRETE FLOOR. 50' front with plate glass display. Bachelor living quarters and storage area are upstairs. It has a total floor space (ground floor) of 6,926 square feet and was built in 1949. Evaporative type air-conditioning and central heating system is used throughout front half of building.

Replacement cost estimated—6,926 sq. ft. at $9.85 . . . $68,212.00.

1014 East 2nd Street

This is a 1 & 2 story ALL METAL STRUCTURAL STEEL HEAVY DUTY BUILDING with CONCRETE FLOOR throughout. It has been used for machine shop operations. The total floor area is 7,625 square feet. This building has two private offices (shop) in NE corner, wash room and store room facilities.

Replacement cost estimated—7,625 sq. ft. at $6.85 . . . $52,231.00.

RAILROAD SPUR IS ACROSS THE 200' BACK OR SOUTH SIDE OF TRACT.

Purchaser should be qualified to obtain land lease from Texas & Pacific Railroad.

Purchaser should arrange for own financing if required.

FOR BUSINESS LIQUIDATION AND QUICK SALE all leasehold properties described above — Price . . . . . $65,000.00 (this is substantially below replacement cost and appraised value).

NOTE: Federal Internal Revenue Agent set depreciation rate on buildings at 10-year life from Feb. 1952 (beginning of corporation). Thus, owner has advantage of fast write-off, without capital invested in non-depreciable land. THIS LAND ADJOINS T&P's MAIN LINE AND WILL NOT BE SOLD. Also fronts on Hiway 80.

for further information

EMPIRE MACHINERY COMPANY, 1010 E. 2nd St., Odessa, Texas, Phone FEderal 2-9161
Or — D. F. Payte, 313 Tower Petroleum Building, Dallas, Texas, Phone Riverside 8-4958

design features, photographs, and applications. Equipment capabilities and specifications are included. **Write or call: Industrial Timer Corp., 1407 McCarter Highway, Newark 4, N. J., for Bulletin 100.**

Offshore-drilling platforms

. . . which are three-legged, are outlined in a new 12-page brochure. Forty-six illustrations help show the work these platforms are doing around the world. The brochure includes a rundown of how the big "portable islands" are constructed, where they are working now, and various performance records which have been established by their operations. The brochure also illustrates and describes proposed future platforms which will operate in waters up to 600-ft. deep. **Write or call: R. G. LeTourneau, Inc., 2399 South MacArthur, Longview, Tex., for Oceans of Experience brochure.**

Constant-duty reels

. . . designed for lifting or supporting rubber-jacketed cords for an uninterrupted power supply, are described in new four-page Bulletin RL 258. It defines construction, uses, and features of new models. The bulletin includes technical data with specification drawings and dimensional tables for weatherproof, dustproof, and explosionproof models. Detailed illustrations show how easy wire connections can be made using less cable, due to a new hollow-shaft design, and how to replace safety cartridges in a matter of minutes by using only a screwdriver. **Write or call: Appleton Electric Co., 1701 Wellington Avenue, Chicago 13, for Bulletin RL 258.**

Protective-coatings bulletin

. . . gives a breakdown of the four classifications of corrosive conditions according to severity of exposure, and provides sketches of appropriate areas in each grouping. Four-page Bulletin 100 contains a simplified chart which enables selection of coatings according to service requirements and gives physical properties and chemical resistance. **Write or call: Carboline Co., 32 Hanley Industrial Court, St. Louis 17, for Bulletin 100.**

Four-cylinder gasoline engines

. . . with L-head designs are featured in three new bulletins—each two pages. The bulletins feature photo illustrations of the subject engines along with basic installation diagrams, general data, power charts, and detailed specifications. **Write or call: Hercules Motors Corp., 101 Eleventh Street, S.E., Canton, Ohio, for Bulletins E-128, E-129, and E-130.**

Temperature-millivolt tables

. . . for thermocouples are given in a new chart, available upon request. The 16½ by 11-in. chart will enable you to convert either fahrenheit or centigrade temperatures, in 5° increments, to millivolt values for eight different thermocouple calibrations quickly. The chart folds in half and is punched for use in a three-ring binder. It's printed in two colors on heavy stock and may also be used as a wall chart. Table values are based on reference junction temperatures of 75° and 25° C. Correction factors for other reference junction temperatures are provided. Temperatures covered are from —320° to 3,270° F., and from —200° to 1,800° C. For any temperature, comparable millivolt values for all calibrations are contained in one location on the chart. You need only find the temperature and read to the right. **Write or call: Thermo Electric Co., Inc., Saddle Brook, N. J., for Temperature-Millivolt chart.**

ROCKFORD

OIL FIELD TYPE

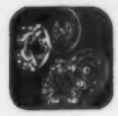
Heavy-Duty

LONG LIFE

POWER TAKE-OFF

➡ Bearings Need Lubrication Only Once a Year

The special, large Timken main bearings in the new ROCKFORD POWER TAKE-OFF are adjusted when assembled at the factory. They require no further adjustment—and run in a reservoir of lubricating oil that needs replenishment not oftener than once a year. The clutch throw-out bearing is lubricated for life and requires no further attention. Cut down on the servicing time needed by your equipment by specifying this new ROCKFORD Oil Field Type POWER TAKE OFF.



Small Spring Loaded

Heavy Duty Spring Loaded

Oil or Dry Multiple Disc

Heavy Duty Over Center

Power Take-Offs

Speed Reducers

BW SEND FOR THIS HANDY BULLETIN Gives dimensions, capacity tables and complete specifications. Suggests typical applications.

ROCKFORD Clutch Division BORG-WARNER

1305 Eighteenth Ave., Rockford, Ill., U.S.A.

Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

CLUTCHES

Core Laboratories, Inc. shifts

W. L. Horner

... its administrative personnel and their staffs from the firm's home-office building to another location in the same industrial area. The move was made to provide additional facilities for Core's expanding engineering and consulting department, under the direction of W. L. Horner, vice president and manager.

Horner, who returned to Core Lab in 1954 to reestablish the company's engineering and consulting activities, noted that the department's personnel has increased from a nucleous of three to a present staff of 30 engineers and geologists. Their operations are supplemented by the firm's special core analysis, reservoir-fluid analysis, and research divisions located in the same building.

According to Horner, both domestic and foreign work, supervised by assistant managers H. M. Shearin and W. P. Schultz, respectively, have shown significant increases during each of the past 4 years.

Garrett appoints two

... new sales engineers—Robert J. Campbell and William T. Latham—both of whom recently completed a company training program.

Campbell will work in the Southwest Louisiana district of Garrett Oil Tools Division of U. S. Industries, Inc. He will headquarter in Lafayette, La.

Latham will work in the South Texas district and will locate in Corpus Christi, Tex.

Meanwhile, Garrett announced the appointment of two new agents to handle product sales.

Belen-Lynn McGuffy Co., Ltd., of Calgary, Alberta, will handle equipment in the provinces of Alberta, Saskatchewan, and Manitoba, and in the Fort Saint John area of British Columbia. Hudson Engineering Co., of Birmingham, Ala., is the new company agent in Alabama, Western Florida, Southern Mississippi, and Central Tennessee.

Alan C. Roberts is elected

A. C. Roberts

... trust officer of Fort Worth National Bank's board of directors, according to Estil Vance, president. Roberts joined the bank in November 1958, as manager of the newly created oil and gas section of the bank's trust department.

He had served as special representative in the Fort Worth office of Cities Service Oil Co. of Delaware, where he handled property acquisition in the company's land department. Before coming to Fort Worth, Roberts was Cities Service's manager of crude-oil purchases and sales in Midland, Tex. In 1937, he began work in the treasury department of Humble Oil & Refining Co., Houston.

SIGNING CONTRACT which calls for protective coating (Polyken tape) to be applied to a 1,616-mile pipeline are: O. Paul Herzig, vice president of engineering, and F. E. Stanley, president of the pipeline company—Houston Texas Gas & Oil Corp.; John C. McIntosh, distributor representative who secured the contract, presently with Cathodic Protection Services; and George C. Stineback, sales director of Kendall Co.'s Chicago division, the Polyken tape manufacturer. The $3 million contract calls for the wrapping of a line that runs from Baton Rouge, La., to Miami, Fla. The pipeline consists of 914 miles of main line and 702 miles of smaller branch lines. In terms of dollars, this installation is the largest single order ever placed for a protective-pipe coating of any kind, and becomes the first major pipeline to be completely wrapped with tape.

Gerould A. Sabin is given

... "Advertising Man of the Year" award at a recent meeting of the Advertising Club of Denver. The award, which has been given to only two other persons in the past, was made for "ethical performance of advertising" during a lifetime career in that field.

Sabin is advertising director of Colorado Fuel & Iron Corp. He began working for CF&I in 1926 as sales promotion director. Four years later he became advertising manager. After CF&I merged with Wickwire Spencer Steel Co. in 1946, he was appointed director of advertising.

L. M. (Pete) Oaks named

... special representative for fishing tool and wire-line services of McCullough Tool Co. He will locate in Calgary, Alberta.

Formerly district sales and service manager for Saskatchewan and Manitoba, Oaks has been with McCullough for 15 years, the past 8 of which have been spent in Canada. In his new post, he will serve primarily as a consultant to the oil industry on fishing tool and electric wire-line services.

J. W. Youngling transfers

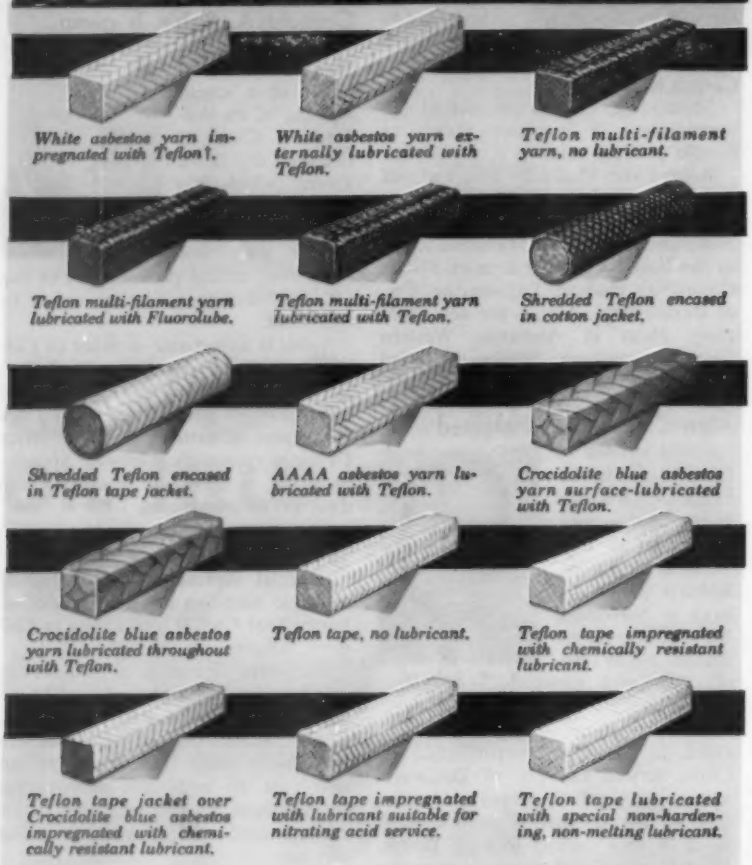
... to Tulsa as city manager for Bovaird Supply Co. He had been working in Wichita, Kans. Youngling joined Bovaird in 1948, after serving with other supply companies. He served at Salem and Clay City, Ill., several years before being transferred to Wichita.

Tretolite Co. holds annual

... sales meeting in St. Louis. Department heads, division sales managers, and assistant division managers participated in the 2-day affair. Session chairman was J. E. Stockton, Jr., sales manager for Tretolite Co., a division of Petrolite Corp.

Other department heads and executive personnel who addressed the group included: Dr. Charles M. Blair, president of Petrolite Corp.; W. C. Adams, vice president and general manager, Tretolite Co.; W. J. Nuelle

15 SPECIFIC PACKINGS FOR ALL CORROSIVE SERVICES



White asbestos yarn impregnated with Teflon†.

White asbestos yarn externally lubricated with Teflon.

Teflon multi-filament yarn, no lubricant.

Teflon multi-filament yarn lubricated with Fluorolube.

Teflon multi-filament yarn lubricated with Teflon.

Shredded Teflon encased in cotton jacket.

Shredded Teflon encased in Teflon tape jacket.

AAAA asbestos yarn lubricated with Teflon.

Crocidolite blue asbestos yarn surface-lubricated with Teflon.

Crocidolite blue asbestos yarn lubricated throughout with Teflon.

Teflon tape, no lubricant.

Teflon tape impregnated with chemically resistant lubricant.

Teflon tape jacket over Crocidolite blue asbestos impregnated with chemically resistant lubricant.

Teflon tape impregnated with lubricant suitable for nitrating acid service.

Teflon tape lubricated with special non-hardening, non-melting lubricant.

John Crane CHEMLON *BRAIDED PACKINGS

Specific service conditions are always best handled with a packing designed for the purpose. This is especially true when it comes to hard-to-handle liquids in pumps, valves, agitators, mixers, plating equipment and similar applications.

For this reason John Crane has developed 15 individual field-proved types of Chemlon Braided Packings. Within this line there is a type and style that will meet any combination of service conditions and requirements.

1. All known industrial acids, alkalis or solvents.
2. Temperatures from −120°F to +600°F.
3. High or low shaft speeds, also valve stems.
4. Longer packing life due to lower coefficient of friction and non-raveling construction.

Send in your service condition and we will recommend a Chemlon Braided Packing best suited to your application. Request Bulletin P-325.

Crane Packing Co., 6419 Oakton St., Morton Grove, Ill. (Chicago Suburb).
In Canada: Crane Packing Co., Ltd., Hamilton, Ont

†*T. M. for DuPont Teflon* **T. M. for the Best in DuPont Teflon*

John Crane

CRANE PACKING COMPANY

and F. L. Kelley, vice presidents, Petrolite; Dr. G. J. Samuelson, director of research, Petrolite; A. F. Wirtel, vice president and chief chemist, Tretolite; C. P. Siess, Jr., assistant sales manager, Tretolite; George Purdy, manager of technical services, and M. A. Luby, of the same department, Tretolite; and Fred F. Hubler, advertising manager, Petrolite.

Francis Anderson is named

Francis Anderson

...manager of Halliburton Oil Well Cementing Co.'s chemical research and development laboratories. He succeeds the post vacated by Hayden Roberts, pioneer Halliburton chemist who recently retired. Anderson, who joined Halliburton in 1940, was formerly assistant manager of the chemical research and development laboratories. In his new position, he is in charge of some 65 technical personnel in the laboratories section of Halliburton's technical center at Duncan, Okla. He also advises the company chemists stationed in domestic and foreign-field operations.

Jack B. Laramy appointed

J. B. Laramy

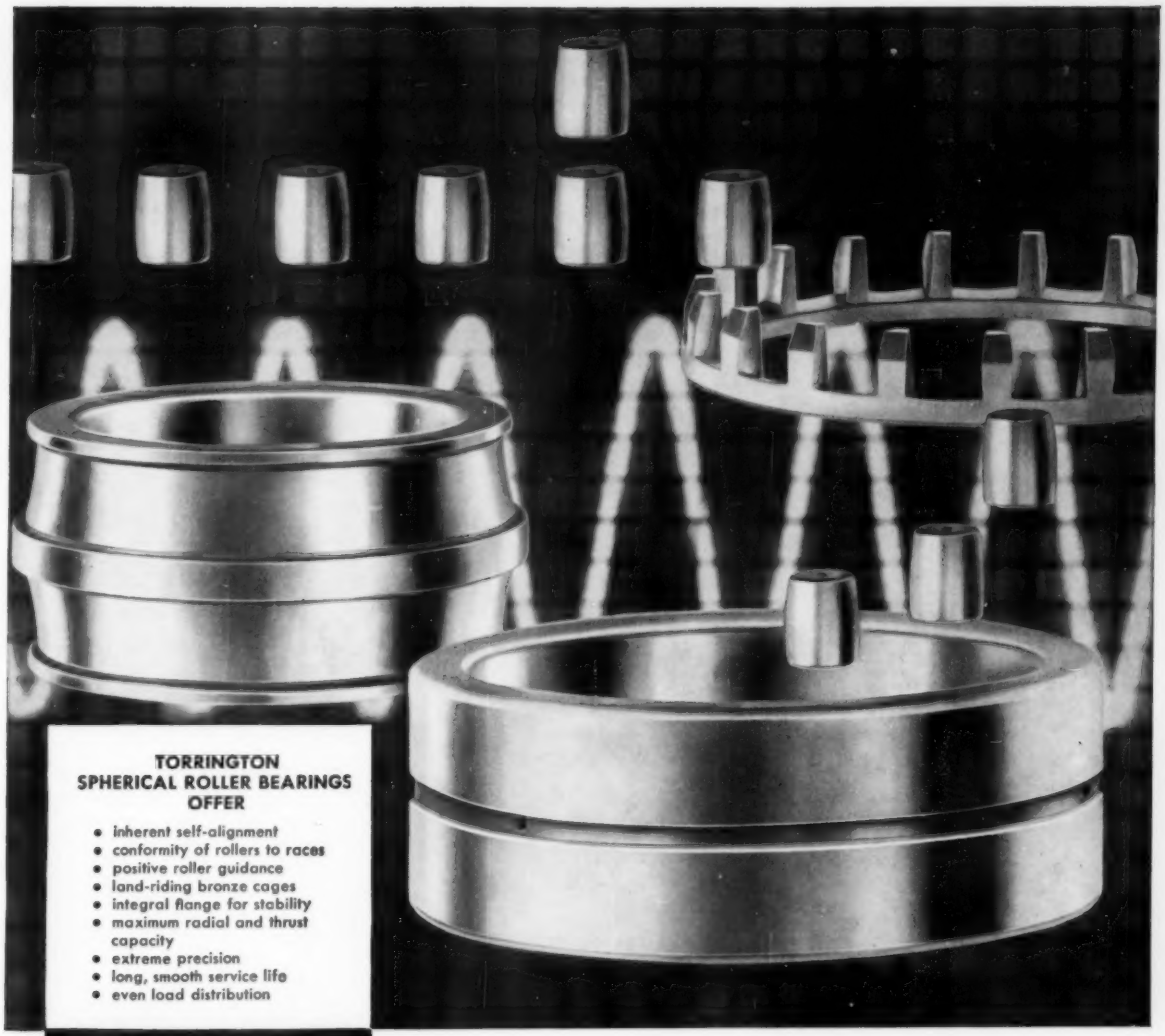
...sales manager of Worthington Corp., Harrison, N. J., division, announces A. M. Tullo, general manager.

Laramy joined Worthington 30 years ago. He served as a general-line salesman and then as assistant manager of the Chicago district office until his appointment in 1951 to manager of the corporation's marketing-research department. For the past 3 years, he has served as assistant manager of the marketing division and eastern regional sales manager.

Maloney-Crawford to assume

...operation of the tank and steel-fabricating facilities of Edmonton Steel Fabricators, Ltd. The announcement was announced jointly by F. G. Winspear, president of Premier Steel Mills, Ltd., and Edmonton Steel Fabricators, Ltd., and G. M. Cheatham, president of Maloney-Crawford Tank & Service Co., Ltd.

Premier Steel Mills, Ltd., which will continue to operate the sucker-rod plant, the tool and die shop, and the machine shop, is expanding these



TORRINGTON SPHERICAL ROLLER BEARINGS OFFER

- inherent self-alignment
- conformity of rollers to races
- positive roller guidance
- land-riding bronze cages
- integral flange for stability
- maximum radial and thrust capacity
- extreme precision
- long, smooth service life
- even load distribution

Send for the new Torrington Spherical Roller Bearing Catalog #258.

Electronics Matches Rollers and Races for Extreme Accuracy

Torrington employs the latest electronic techniques to insure precise geometric relation between components of Torrington Spherical Roller Bearings.

Roller diameters of a given complement are matched within .0001" of each other. For ultra-precision bearings, tolerances are even closer. Inner and outer races are as rigorously classified. Components are selected for assembly to provide accurate diametrical clearance. The result is bearings of unparalleled accuracy for minimum wear and friction, smooth operation and long service life.

Torrington's care for these details of accuracy is matched only by our care in matching the *right* bearing to the *right* job. In this, you can rely on your Torrington representative and the facilities of Torrington's Engineering Department. **The Torrington Company, South Bend 21, Ind.—and Torrington, Conn.**

TORRINGTON BEARINGS

District Offices and Distributors in Principal Cities of United States and Canada

SPHERICAL ROLLER • TAPERED ROLLER • CYLINDRICAL ROLLER • NEEDLE • BALL • NEEDLE ROLLERS • THRUST

CLARK

CLARK BROS. CO.
compressors and
gas turbines

DRESSER DYNAMICS

DRESSER DYNAMICS, INC.
advanced scientific research

DRESSER IDECO

DRESSER-IDECO
COMPANY
steel structures

DRESSER
MANUFACTURING
DIVISION

DRESSER MANUFACTURING
DIVISION—couplings

THE GUIBERSON
CORPORATION

THE GUIBERSON
CORPORATION
oil tools

Hermetic Seal Transformer Co.

HERMETIC SEAL
TRANSFORMER CO.
electronic transformer
development

IDECO Inc.

IDECO, INC.
drilling rigs

Offshore geophysical exploration is dramatic and exacting. Vibrations created by explosive charges are reflected by geophones to the SIE designed and built instruments on recording boats. The search for oil calls for the highest scientific skills and requires unfailing and precise equipment performance. The Dresser Companies provide a comprehensive range of products and services designed to maximize the chances of finding oil, thus lowering discovery and development costs.

LANE-WELLS COMPANY
technical oilfield services

Magcobar
MAGNET COVE BARIUM CORP.
drilling mud

PACIFIC
PACIFIC PUMPS, INC.
pumps

ROOTS-CONNERSVILLE BLOWER DIVISION
blowers and meters

Security
SECURITY ENGINEERING DIVISION—drilling bits

SIE.
SOUTHWESTERN INDUSTRIAL ELECTRONICS
electronic instrumentation

WELL SURVEYS
WELL SURVEYS, INC.
nuclear and electronic research

The SS Edward L. Steiniger, named for Sinclair's president, speeds out for another cargo.

A Capital Ship for a Profitable Trip

"The finest work horse in the Sinclair fleet" is the way W. N. Damonte, manager of marine operations, describes this new 44,000-ton tanker. A high-speed ship, with no frills, she was built with one thought in mind — rock bottom per-barrel carrying costs.

The Edward L. Steiniger brings to almost half a million tons the cargo carrying capacity of tankers serving the integrated Sinclair organization. These ships provide the economical transportation so essential to a business dealing in a bulk commodity such as petroleum. Tailored to the special requirements of the Corporation's domestic and foreign operations, these tankers contribute markedly to Sinclair's profitable growth.

SINCLAIR

A Great Name in Oil

SINCLAIR OIL CORPORATION • 600 FIFTH AVENUE • NEW YORK 20, N. Y.

facilities to manufacture additional items of supply for the oil industry.

The company also is installing $200,000 worth of nut and bolt plant equipment. This will constitute the first nut and bolt manufacturing facility in Alberta.

Ray O. Branam is elected

R. O. Branam

. . . vice president and director of Midwestern M f g. Co., Tulsa, reports Armon H. Bost, president. Branam had served as Midwestern's general manager in charge of engineering, production, and sales for a year. Branam formerly worked for Emsco Mfg. Co., Hugh Tool Co., and Unit Rig & Equipment Co., in the areas of product design, production, supervision, and sales engineering.

J&L stocks its Canadian

. . . stores with replacement parts for Gardner-Denver mud pumps. The report comes from W. L. Wolfe, vice president, sales, of Jones & Laughlin Supply Division. J&L is exclusive distributor for Gardner - Denver mud pump replacement parts and codistributor for their mud pumps in the United States with the exception of California.

Harold Brown is appointed

. . . general sales manager of Walworth Co., in which capacity he will supervise the activities of the company's division manager and advertising manager.

Brown joined the company last year as assistant manager of technical sales service. Before joining Walworth, he was vice president of Metallurgical Associates, Inc., a consulting firm in New York City. Prior to that, he was vice president in charge of sales at Hunt Spiller Mfg. Corp. in Boston.

Homco makes 11 changes

H. J. Bish, former district superintendent at Edinburg, was assigned to Export and will be stationed at Maracaibo, Venezuela. J. W. Caskey, Jr. takes over as sales representative for the Western states of Houston Oil Field Material Co., Inc. He had been Rocky Mountain division superintendent.

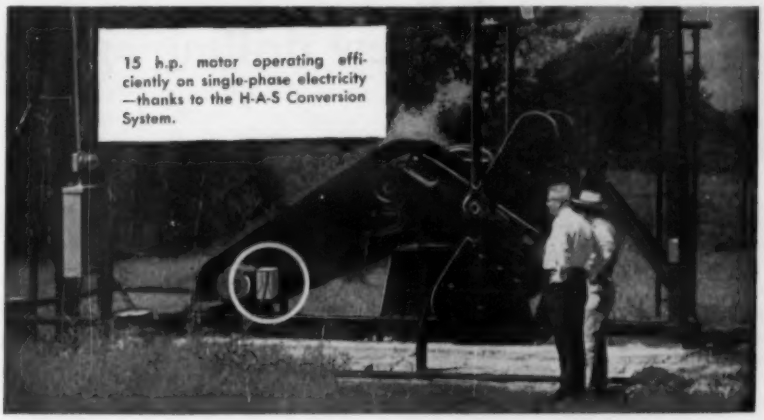
A. J. Flowers moves from warehouse clerk to assistant store manager at Casper, Wyo., and Jack Hallonquish was transferred from Liberty, Tex. to Farmington, N. M., where he will continue to work in sales.

George Haltom, former manager of machinery sales, was promoted to assistant sales manager at Houston. William A. Hawthorne was named division sales and service representative in West Texas. He had been with Homco International in South America. Warren Hollier was changed from Rocky Mountain division manager to division manager of sales and services in Casper. Lester Long was promoted from salesman to resident manager in Denver.

George Rush, former district superintendent in Odessa, Tex., takes over as district manager in Paris, France. Jess Strickland is the new division sales representative at Casper. He was promoted from store manager. J. B. Summer was promoted from fishing-tool supervisor to district manager at Edinburg, Tex.

Ben M. Queen transferred

. . . from Lufkin, Tex., to the Mid-Continent division office at Tulsa, where he will be a sales engineer for Lufkin Foundry & Machine Co. Since 1950, Queen has engaged in oil-field sales work in Kansas, Colorado, Montana, Louisiana, and Texas.



Write for this NOW!

"How to use three-phase motors on SINGLE-PHASE CURRENT"

. . . and profit from the added economy and efficiency!

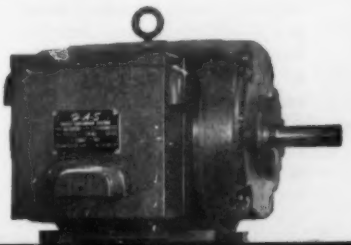
Three-phase motors cost less than single-phase motors, are more efficient and have far greater salvage value.

The New H-A-S Phase Conversion System enables you to use three-phase motors (3 h.p. or larger) on 220 V single-phase current. Three-phase motors cost less, operate for less, and can be used later on three-phase current.

The H-A-S is available in two models, for motor mounting and remote mounting.

On many rural single-phase lines service is limited to 5 h.p. single-phase motors, but the H-A-S Phase Conversion System permits the use of three-phase motors up to 75 h.p.

This is GOOD NEWS in the oil country. To solve an immediate problem—or for your files—write NOW for complete details and the name of your nearest supply store or distributor!



KEN ELLIOTT MOTORS, Inc.
P. O. Box 5158-A
BOSSIER CITY, LOUISIANA

H-A-S PHASE CONVERSION SYSTEM

An important announcement to the drilling industry--

Drilling Contractors have found they get up to 50% FASTER DRILLING, 25% LONGER BIT LIFE, SUBSTANTIAL DOLLAR SAVINGS with DOWELL'S new drilling agent--POLYDRIL!

A brand-new aid for the rapid settling of solids in clear water drilling is now available from Dowell. The product is Polydril*, an *easy-to-mix, low-cost,* water-soluble, organic polymer. Polydril helps you increase drilling rates and bit life, and lower water and mud costs.

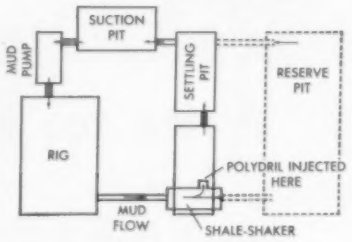
Polydril is, first, a powerful, efficient flocculating agent. But, of special importance, is the fact that Polydril comes to you in a semi-liquid state. This means that it is easy-to-mix, easy-to-use, with no waste or loss. There is no product on the market today quite like Polydril.

POLYDRIL IS EASY-TO-MIX

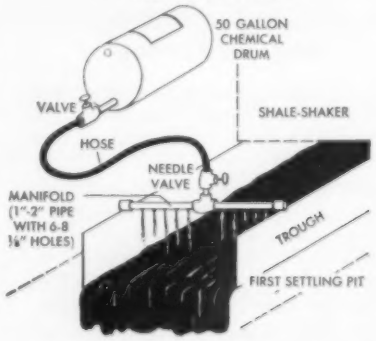
To illustrate the ease with which Polydril can be added to your drilling operation, here are the steps usually followed:

1. Stir the Polydril in the can to a uniform mix just as you would paint.
2. Mix a pint (approximately one-half mud cup or 1 to 1¼ pounds) of Polydril with an equal volume of diesel oil or kerosene.
3. Pour this mixture slowly and uniformly into a stream of water going into a 50-gallon chemical mixing drum. Either fresh water or brine may be used. This makes 50 gallons of treating solution.
4. Inject the treating solution directly into the mud stream between the shale shaker and the first settling pit. Disperse the solution as thoroughly as possible into the stream. A manifold arrangement has been found to be satisfactory for this purpose. (See sketch.) Also, if there is agitation in the mud

DIAGRAM OF FLOW SYSTEM SHOWING POINT AT WHICH POLYDRIL IS INJECTED



MANIFOLD ARRANGEMENT FOR INJECTION OF POLYDRIL



stream at this point, the Polydril will be better dispersed; and the solids will be flocculated more efficiently.

5. For best results, keep agitation at a minimum through rest of the mud system.

OTHER USES OF POLYDRIL

Other than as an aid in clear water drilling, Polydril has several additional applications. For example, it can be used:

To help settle mud pits after drilling operations are completed.

To clear muddy water for use as a fracturing fluid.

AVAILABILITY OF POLYDRIL

Polydril is available at all Dowell stations in handy 5-gallon re-usable cans with handles. Each can contains 50 pounds of Polydril.

New as it is, Polydril has already enjoyed wide success in hundreds of wells. The sum of its advantages—faster drilling, reduced rig time, increased bit and pump-liner life, reduced water requirements, mud savings, mixing ease—makes Polydril an important contribution to the progress of oil well drilling. With all these advantages, Polydril is surprisingly inexpensive; and a small amount goes a long way.

Investigate Polydril. For detailed information and prompt service, call any of the 165 Dowell offices and stations. In Canada, call Dowell of Canada, Ltd.; in Venezuela, United Oilwell Service. Dowell, Tulsa 1, Oklahoma.

*Dowell Trademark

Products for the oil industry

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

Bawden buys Trident Drilling Co. to form 24-rig company

PURCHASE by Peter Bawden Drilling, Ltd., Calgary, Alta., of Trident Drilling Co., Ltd., also of Calgary, makes it the second-largest drilling contractor in Canada in number of rotary rigs under its direction.

The two drilling companies have 24 rigs in operation. Ten of these are rated to drill to depths below 9,000 ft. The transaction is regarded as the largest single purchase of drilling equipment in the history of western Canada's oil industry.

Bawden will continue to operate its newly acquired facilities under the Trident name. Gordon B. Graalman, formerly of Trident, will remain general manager.

Trident has been a subsidiary of Bailey Selburn Oil & Gas, Ltd. George H. Sellers, president of the latter company, said that his company was influenced in the sale of its drilling assets by a "growing reluctance on the part of major exploration and development companies to utilize services of drilling firms that are directly affiliated with other companies in the same line of endeavor who might be considered competitors."

The Bawden organization had its beginning in 1952, starting with one rig operating in Alberta. All its rigs now are in Alberta, northeastern British Columbia, or Northwest Territories.

Who's getting the drilling contracts

El Dorado Drilling Co., El Dorado, Ark., has a new wildcat operation in southeastern Union County, South Arkansas. It is a contract job for Creslenn Oil Co. Plans call for a Cotton Valley test with depth objective at 6,000 ft. Location, 1 Olin, in 19-19s-11w, is on the La Pierre Creek prospect. It is 3½ miles south of Lapile, and 5 miles west of Huttig.

Justiss-Mears Drilling Co., Jena, La., has the contract on another well Shell Oil Co. is starting in the new Westwood field, in northern Tensas Parish, eastern Louisiana. Its location is north of Shell's discovery well, completed last September with production from a 7,350-ft. Tuscaloosa sand. Shell's east offset to the discovery also has proved productive, but its latest test, 2,000 ft. southwest of the discovery has just been abandoned as dry.

Oil Production Maintenance, Inc., Houston, will drill an 8,200-ft. test 2½ miles north of Vidor, in Orange County, southeastern Texas. It is a contract operation for Mattexco, Inc., and F. D. Matthews, Jr., also of Houston. Location of the test, 1 Miller Vidor Lumber Co., is a mile south of North Vidor field.

H. L. Edwards Drilling Co., Houston, is moving a rig to the recently opened North Ossum field, in Lafayette Parish, South Louisiana, where it will drill for Continental Oil Co. Continental's initial location, 1 Ossum Unit 5, is a half mile west of the discovery well, drilled by J. P. Owen and associates with an Owen rig. The latter well, completed last December, is productive of gas and condensate from a 12,850-ft. sand. Owen's rig now is on its third test in the area.

Dellson Drilling Co., Denver, is getting under way on a wildcat it has contracted to drill for National Cooperative Refinery Association on Overland Dome, southeast of Rawlins, in Carbon County, Wyoming. Contract calls for a 6,000-ft. Morrison test at 1 Government - Wallway, in 24-20n-84w.

Eagle Drilling & Development Co., Natchez, Miss., is drilling for Calto Oil Co. and G. W. Gulmon on their south offset and confirmation test for Cameron & Callon's newly completed discovery well of Galilee field, in Adams County, southwestern Mississippi. The discovery well (1-A Foster), in 4-7n-1w, is oil-productive from 5,700-ft. Wilcox sand. The Calto and Gulmon offset, 1-T Armstrong, has permit for 5,850 ft.

Clayton & Severns Drilling Co., Bakersfield, has moved a rig into North Tejon field, Kern County, California, where it will drill for Richfield Oil Corp. This will make four rigs Richfield has running in this active area, discovered 16 months ago. Clayton & Severns' first well is at KCL-I No. 43-24. It is projected to the area's currently productive Vedder-Eocene zones.

BUSINESS and PLEASURE in TULSA means-

THE MAYO
world-famous HOTEL
Completely AIR-CONDITIONED
600 ROOMS
ADJACENT GARAGE

Do you need . . .
AIR DRILLING EQUIPMENT?
We have the know-how through experience and have Le Roi proven Air Drilling Equipment to meet most requirements—any capacity—pressures up to 1500#—Rental with option of purchase—Sales.
Write or phone, we will gladly arrange for a meeting at your convenience.
MIDWESTERN ENGINE AND EQUIPMENT CO., INC.
(Le Roi Distributors)
4645 Southwest Blvd. P. O. Box 1886
Phone: HI 6-6144
Tulsa, Oklahoma

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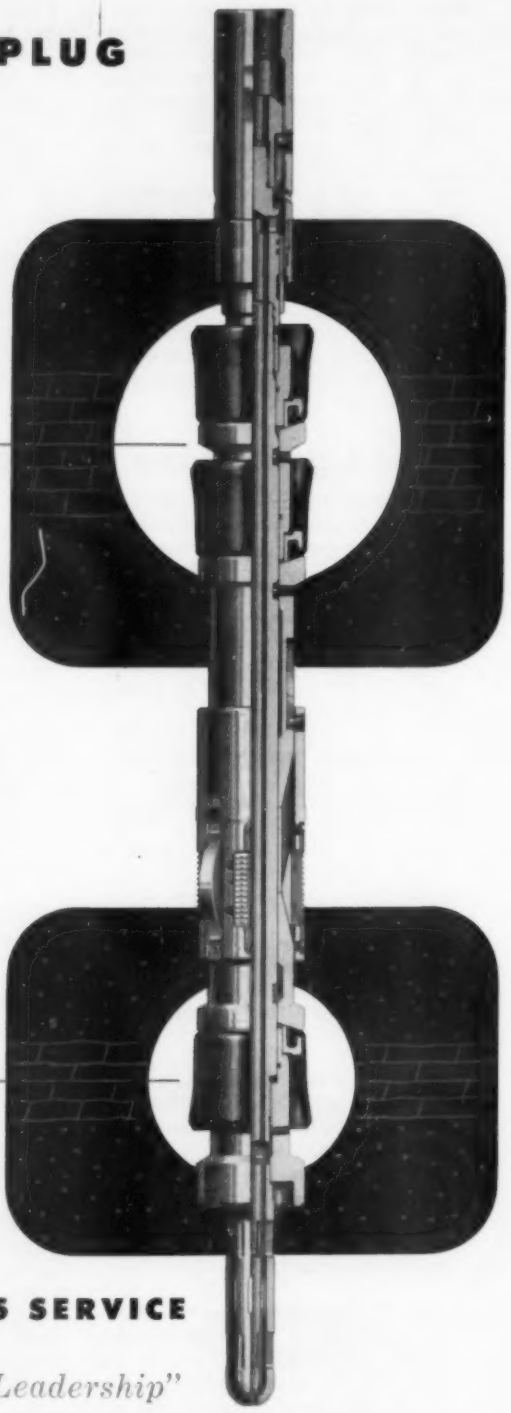

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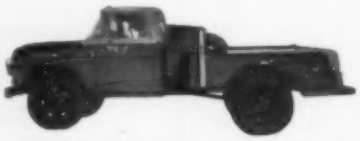

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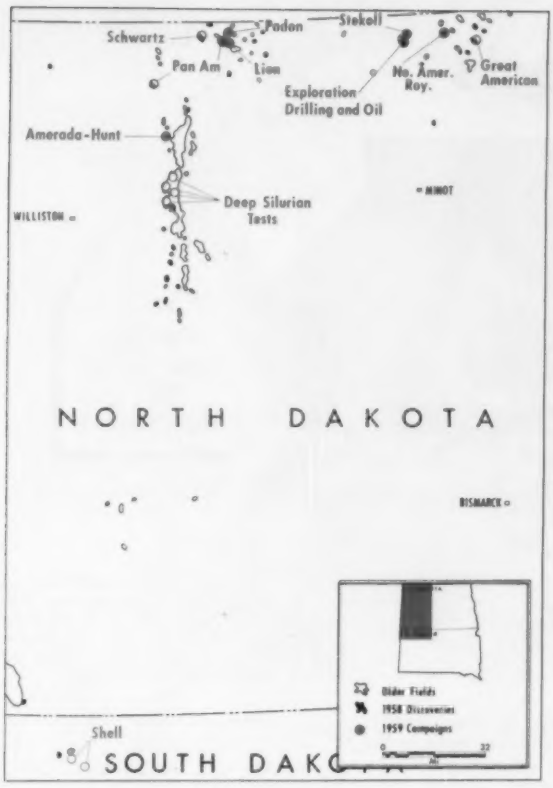

TEN NEW DISCOVERIES and extensions in 1 month indicate another record year for North Dakota. South Dakota also has two new wells on the way.

North Dakota bags 10 in first month

BY FRANK J. GARDNER

ONLY 3 YEARS AGO, North Dakotans were casting covetous eyes over the fence at their neighbors in Saskatchewan, who were having a wonderful time opening one new oil field after another. Seemingly, Mother Nature had generously endowed the Canadians and thrown only the leavings to Dakota. At that time this column commented that ". . . The geologists in the basin refuse to recognize the forty-ninth parallel as an effective barrier to the migration of oil, and the success spree now going on in southeastern Saskatchewan should spread southward in months to come."

It didn't take long. In 1957, eastside Williston basin operations began to pick up, and success smiled on North Dakota with 23 new fields. Gathering steam in 1958, the play netted a record 449 wells for the state, and 25 new fields.

Another record year . . . Judging from January activities, yet another record is in the cards for 1959. During this first month, 10 new fields and important extensions have been racked up.

Opening the year with a bang was J. R. Padon's 1 Hansen, 12-163n-92w, in Burke County. From the Nesson-Mississippian pay at 5,848-58 ft., this discovery flowed 191 bbl. per day on 13/64-in. choke.

Early in the month, Stekoll Oil & Gas Co. et al. reported good showings in the Madison-Mississippian at its 1 Johnson, 19-163n-82w, Bottineau County. Tests of Madison and Mission Canyon are still under way here, at depths of 3,923 and 3,953 ft.

Pan American Petroleum Corp. has contributed two of North Dakota's 1959 finds. Near the Canadian border, in Burke County (27-163n-92w), the 1 Bly was finished for a flush 1,200 bbl. daily from Midale and Nesson pays at 6,170-90 and 6,197-6,210 ft. This is a north extension to Rival field; Pan Am has staked a north offset at the 1 Huttner-Bank of North Dakota. In the same vicinity, Lion Oil (Monsanto Chemical Co.) has reported flows of 40 bbl. hourly at its 1 Bly (36-163n-92w); this lies 1 mile northwest of Lignite field and 1½ miles west of South Rival field.

And a larger theater . . . Pan American's second discovery is indicated 6½ miles northwest of North Tioga field at the 1 Bakken Unit, 29-161n-95w, in Divide County. Here, good showings of oil have been reported in cores and drill-stem tests of the Midale and Nesson at 7,487-7,529 ft.

Back to the eastern edge of operations, we find three more strikes made or in the making. North American Royalties finished its 1 McDougall Estate (19-163n-80w, Bottineau County) for a small pumper at 22 bbl. daily from Spearfish-Triassic at 3,400 ft. The well lies 2 miles northwest of Westhope field. In 36-163n-83w of Bottineau County, Exploration Drilling & Oil Co. and R. L. Fulton completed the 1 Pearson as a Mission Canyon producer at 4,027-37 ft., with pump potential of 98 bbl. daily; this is a good south extension to Haas field. Great American Exploration Co., at its 1 Martinson (3-162n-79w), evidently has bagged a third Bottineau County field; production casing has been set in Midale, where cores at 3,231-91 ft. revealed good oil showings.

Swinging back to the west and Burke County, a northeast extension to two-well Columbus field is being scored at Tom Schwartz 1 Stompro (22-163n-93w). This one has had good recovery of oil on tests of the Nesson, topped at 6,204 ft. Production casing has been set and tests are continuing.

As a climax to all this activity, Amerada Petroleum Corp. and Hunt Oil Co. have finaled the 1 2-A North Dakota-C as a good Devonian discovery in 16-158-95w in Williams County. This well, 2 miles west of Tioga field, and on the west flank of the Nesson anticline, made 277 bbl. of oil and 44 bbl. water per day on potential test of perforations at 9,980-10,012 and 10,020-74 ft.

Will make history . . . Couple all these discoveries with a new four-well deep Silurian campaign on Nesson itself, and Shell Oil Co.'s revitalized wildcat program for South Dakota, and you can reach only one conclusion: the Dakotas will make oil history in 1959.

Paleozoic oil prospects look good in eastern Nevada

SHADED PORTION of Nevada map is discussed. Drilling rig (left) is Shell Oil Co. Eagle Springs Unit 1, first oil well in Nevada.

BY E. G. JOHNSON
Geologist
Continental Oil Co., Ventura, Calif.

THE OIL PLAY that was touched off by the discovery of commercial quantities of oil by Shell Oil Co. in Railroad Valley, Nye County, Nevada, in 1954 has gradually subsided.

Production in the discovery well coming from Tertiary pyroclastics led to uncertainty as to the origin of the oil; many believing that the underlying Tertiary fresh-water limestones and shales provided the source for petroleum, thus leading to a concentration of leasing and drilling of Tertiary prospects. At the time, Gulf Refining Corp. was active in drilling Tertiary surface and seismic structures in Elko County. All but one failed to have showings of live oil. Moreover, subsequent tests drilled or structures delineated by seismic methods in the intermountain basins were disappointing.

Attraction continues . . . Despite these discouraging results, eastern Nevada continues to attract the interest of oil men. At present the exploratory effort is largely directed toward a better understanding of regional stratigraphy and structure in the Great basin. The many Paleozoic structures exposed or lying along structural trends into the valleys will receive the major share of attention in the future. Also, accumulated experience and refinements of geophysical methods will no doubt lead to a solution of some of the difficult problems encountered in prospecting for oil in the deeply filled valleys.

History of Exploration

Extensive surface exploration has been carried out by major oil companies in Nevada in the last 10 years. Relatively little was known about the geology of the state in general before that time, as previous mapping by the federal Government and state agencies was confined largely to the mining districts.

A much better understanding of the geology of eastern Nevada is beginning to emerge as a result of the combined efforts of oil companies, state and federal geological surveys, university groups, and individuals in the last decade. However, much more field work is needed in areas where the stratigraphic section is exposed, primarily to help in understanding the geology of the Paleozoic column in the intervening areas where valley fill and Tertiary lake beds mask the geology of the underlying desposits.

Geophysical . . . Seismic methods were first employed in the valleys of eastern Nevada in 1950. Geophysical activity reached its peak in the winter of 1954-1955 with 9 seismic and 11 gravity-meter crews active in the state. A gradual decline was noted in 1955 with seismic activity ending in the summer of 1956 and gravity meter a few months later.

Results of geophysical prospecting proved to be disappointing for several reasons. Exploration will continue to be hampered by the masking effect of the overburden which covers approximately 60% of eastern Nevada until such time as some of the early difficulties encountered in the basins have been overcome.

Drilling . . . Exploratory drilling has been carried on sporadically since the early twenties. Major oil-company drilling activity was not initiated until 1950 when the first of three exploratory wells was drilled by Continental Oil Co. and Standard Oil Co. of California as joint operators. Since that time approximately 25 wells have been drilled into the Paleozoic section. Most of these wells had oil and gas showings ranging from minor staining to good showings of live oil. Of this number, less than one-half were intended to test the Paleozoic sediments.

Additional wells drilled by independents or individuals during this

About the author . . .

The author, E. G. Johnson, is a geologist for Continental Oil Co.'s western region in Los Angeles. He has worked in Nevada for about 6 years, and has gained considerable experience with drilling activities in the sector of the state covered in this article.

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- *has at least nine possible petroleum provinces*
- *has the highest peak in North America (Mt. McKinley, 20,257')*
- *was discovered by a Dane, Vitus Bering, in 1741*
- *has a 6,640-mile coastline*
- *has, as its approximate geographic center, a point in latitude 63° 46', longitude 152° 20'*
- *has produced some oil since the early 1900's*
- *has, as its state flower, the Forget-me-not,*

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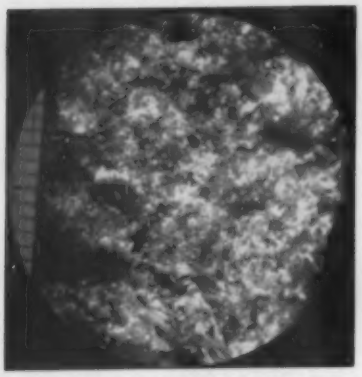
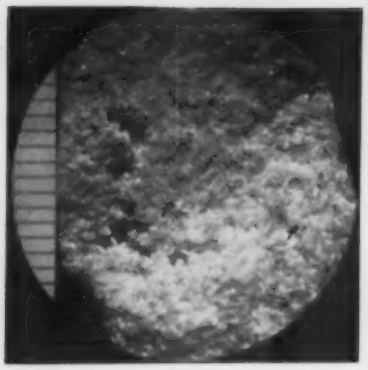
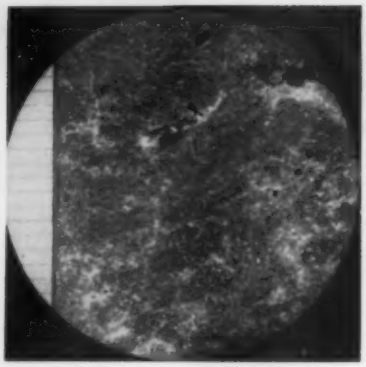
Nevada formations . . .



LONE MOUNTAIN dolomite of Silurian-Devonian age is very coarse with vugs. 2½ times actual size.

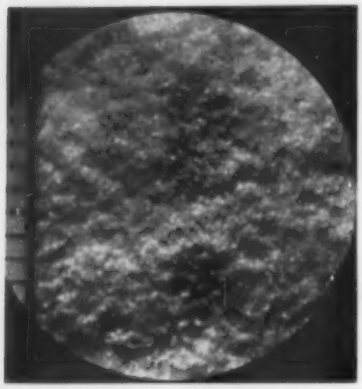


NEVADA DOLOMITE of Devonian age is coarse showing small fractures along f-f'. 2½ times actual size.

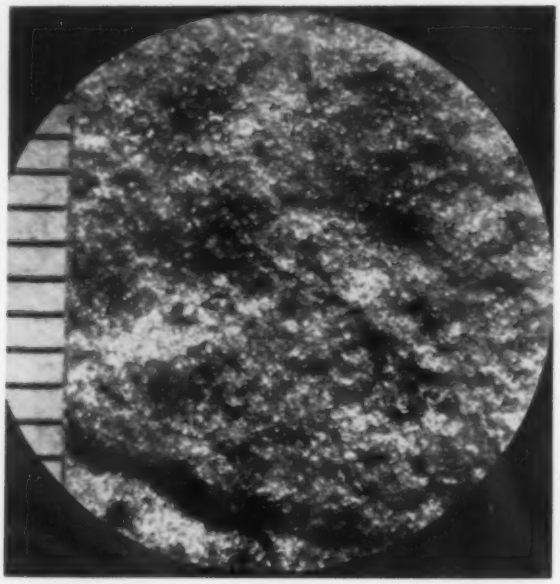


ROBERTS MOUNTAIN dolomite of Silurian age is fine-grained and oil-stained with fractures (f-f'). 2½ times actual size.

compare favorably . . . with Oklahoma pay



EUREKA SAND, Middle-Ordovician, is clean and friable with good porosity and permeability indicated. These sands never penetrated by any Nevada well. 3 times actual size.



McLISH SAND is a well-known pay in the Mid-Continent area. Sample of this Ordovician sand taken from southern Oklahoma. Comparison of Eureka to McLish above indicates approximate grain size of 0.20 mm. 5¼ times actual size.

period were undertaken with little geological information, and they were not drilled deep enough to test effectively the oil potential of the Paleozoic formations of their areas.

Structural and Stratigraphic History

The Great basin was divided into two major sedimentary basins during much of Paleozoic time, resulting in deposition of clastic rocks in western Nevada and predominately carbonate rocks in eastern Nevada and western Utah. In early Carboniferous time, there was uplift and eastward thrusting in central and western Nevada, resulting in markedly different sedimentation in the carbonate basin eastward from the line of thrusting. The Carboniferous and Permian rocks are characterized by rapid lateral facies changes with clastic rocks predominating, intertongueing in an easterly direction with carbonates and shales in western Utah.

Emergence began near the end of Permian time over most of eastern Nevada. Although knowledge of the sequence and relative importance of the different structural features developed during the Mesozoic and part of the Cenozoic eras is sketchy, due to the lack of sedimentary records, it is believed that major folding and faulting began in Jurassic time in western Nevada and advanced eastward during the remainder of the era. The resulting structures were north-south trending closely folded anticlines and synclines often associated with longitudinal thrust faults and transverse tear faults.

Later crustal adjustments resulted in block faulting which produced the present Basin and Range topography. This faulting, largely of the normal type, probably began in the early Tertiary period and in some places continues to the present.

Western and Central Nevada offers little possibility for the accumulation of oil in the Paleozoics as the area is highly folded and faulted and the

sediments are metamorphosed over large areas.

Great thickness of sediments . . . Eastern Nevada gives promise of becoming an important oil province. An almost complete sequence of marine Paleozoic sediments is present, averaging approximately 16,000 ft. in thickness above the Cambrian. In general, the possibilties for generation of oil is directly proportional to the volume of sediments. Although this may not be taken as a basis of comparison of Paleozoic rocks with that of the Teritary marine sediments, it does offer some basis for measuring the potentiality of eastern Nevada as an oil province.

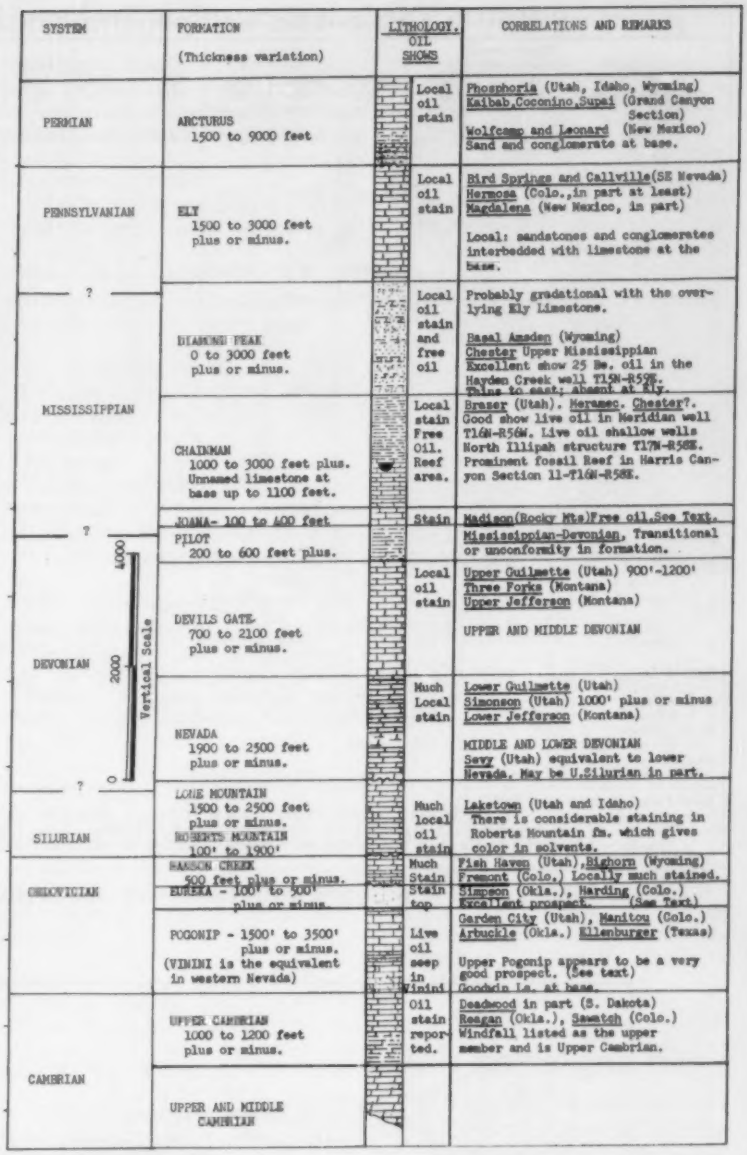
Source and reservoir beds . . . The varied lithology offers ample source material throughout the Paleozoic column. Liquid petroleum is found in fossil casts of the Mississippian-Chainman shale. Oil shales of the same age are exposed near the city of Elko and elsewhere. Showings of live oil were encountered in fractured limestone near the base of the Chainman formation, and in vug openings in the Lower Mississippian-Joana limestone in the Continental-Standard Meridian well drilled in Southwest White Pine County. The overlying Diamond Peak formation has several hundred feet of permeable medium to fine-grained sands over much of the area.

Massive bedded fine to coarsely-crystalline limestones and dolomites are common in the thick (6,000 ft.) carbonate series from the top of the Devonian to the Middle Ordovician-Eureka formation. Fractures, solution cavities, and cavernous voids are common in many members. Several disconformities within the sequence and the associated clastic limestones are favorable for the accumulation of oil. Parts of the section are oil-stained over considerable thicknesses and are rich in organic matter.

The Eureka formation has several fine-grained clean, white sand beds with good permeability in some areas and is highly fractured. The underlying Lower Ordovician-Pogonip limestone has several hundred feet of massive bedded very fossiliferous limestone near the top.

Origin of Eagle Springs oil . . . As has been noted, production of oil in the discovery well on Shell's Eagle Springs unit in Railroad Valley is from fractured Tertiary pyroclastics. The two succeeding development wells produce oil from Tertiary fresh-water limestones and Permian marine limestones. All of the Eagle Springs unit wells which penetrated the Paleozoic section had oil showings many hundreds of feet below the Tertiary. It is concluded by many that the oil accumulated in a common fractured reservoir along a brecciated fault zone bounding the front range, and that the oil had its origin in the Paleozoic sediments below the reservoir.

The premise is further supported by the occurrence of similar oil previously noted in the Continental-Standard Meridian well, and by good showings of oil in cores from the Upper Mississippian - Diamond Peak (Illipah) sands in the Continental-Standard Hayden Creek well drilled on an east-flank fold of the Illipah uplift 20 miles east of the Meridian well.


SYSTEM
FORMATION
(Thickness variation)
LITHOLOGY, OIL SHOWS
CORRELATIONS AND REMARKS
PERMIAN
ARCTURUS
1500 to 9000 feet
Local oil stain
Phosphoria (Utah, Idaho, Wyoming)
Kaibab,Coconino,Supai (Grand Canyon Section)
Wolfcamp and Leonard (New Mexico)
Sand and conglomerate at base.
PENNSYLVANIAN
ELY
1500 to 3000 feet plus or minus.
Local oil stain
Bird Springs and Callville(SE Nevada)
Hermosa (Colo.,in part at least)
Magdalena (New Mexico, in part)
Local: sandstones and conglomerates interbedded with limestone at the base.
MISSISSIPPIAN
DIAMOND PEAK
0 to 3000 feet plus or minus.
Local oil stain and free oil
Probably gradational with the overlying Ely Limestone.
Basal Amsden (Wyoming)
Chester Upper Mississippian
Excellent show 25 Bo. oil in the Hayden Creek well T15N-R52E. Thins to east; absent at Rly.
CHAINMAN
1000 to 3000 feet plus. Unnamed limestone at base up to 1100 feet.
Local stain Free Oil. Reef area.
Brazer (Utah). Meramec. Chester?.
Good show live oil in Meridian well T16N-R56W. Live oil shallow wells North Illipah structure T17N-R56E.
Prominent fossil Reef in Harris Canyon Section 11-T16N-R58E.
JOANA- 100 to 400 feet
Stain
Madison(Rocky Mts)Free oil.See Text.
PILOT
200 to 600 feet plus.
Mississippian-Devonian, Transitional or unconformity in formation.
DEVONIAN
DEVILS GATE
700 to 2100 feet plus or minus.
Local oil stain
Upper Guilmette (Utah) 900'-1200'
Three Forks (Montana)
Upper Jefferson (Montana)
UPPER AND MIDDLE DEVONIAN
NEVADA
1900 to 2500 feet plus or minus.
Much Local stain
Lower Guilmette (Utah)
Simonson (Utah) 1000' plus or minus
Lower Jefferson (Montana)
MIDDLE AND LOWER DEVONIAN
Sevy (Utah) equivalent to lower Nevada. May be U.Silurian in part.
4000
2000
0
Vertical Scale
SILURIAN
LONE MOUNTAIN
1500 to 2500 feet plus or minus.
ROBERTS MOUNTAIN
100' to 1900'
Much local oil stain
Laketown (Utah and Idaho)
There is considerable staining in Roberts Mountain fm. which gives color in solvents.
ORDOVICIAN
BARTON CREEK
500 feet plus or minus.
Much Stain
Fish Haven (Utah),Bighorn (Wyoming)
Fremont (Colo.) Locally much stained.
EUREKA - 100' to 500' plus or minus.
Stain top
Simpson (Okla.), Harding (Colo.)
Excellent prospect. (See Text)
POGONIP - 1500' to 3500' plus or minus.
(VININI is the equivalent in western Nevada)
Live oil seep in Vinini
Garden City (Utah), Manitou (Colo.)
Arbuckle (Okla.) Ellenburger (Texas)
Upper Pogonip appears to be a very good prospect. (See text)
Goodwin Ls. at base.
CAMBRIAN
UPPER CAMBRIAN
1000 to 1200 feet plus or minus.
Oil stain reported.
Deadwood in part (S. Dakota)
Reagan (Okla.), Sawatch (Colo.)
Windfall listed as the upper member and is Upper Cambrian.
UPPER AND MIDDLE CAMBRIAN

PALEOZOIC STRATIGRAPHIC section in East Central Nevada adapted from Continental Oil Co. field reports, U.S.G.S. Professional Paper 276, and field observations by author.

Numerous structures . . . Structural deformation in the Great basin has produced all types of folding and faulting, resulting in innumerable traps of all sorts.

Many traps containing commercial quantities of oil may exist. In addition to the many folds and combinations of structural traps the possibilities of stratigraphic traps are important.

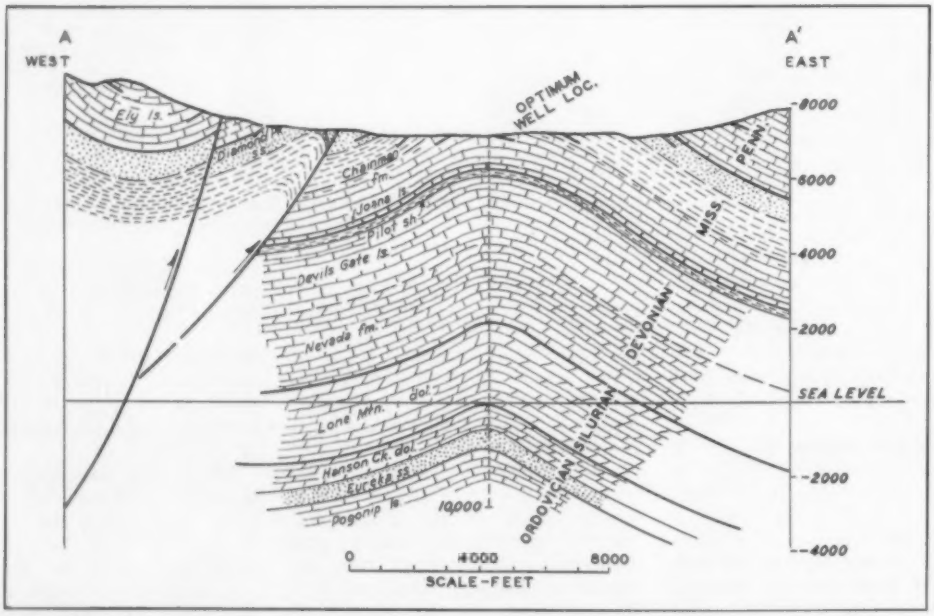
Lateral facies changes in the Carboniferous and Permian add to the oil potential of the area. The eastward thinning of the Diamond Peak sands,

Paleozoic well-penetration chart

Operator and well	Exploration methods: Seis.	Exploration methods: Surf.	Perm. (ft.)	Penn. (ft.)	Miss. (ft.)	Dev. (ft.)	Sil. (ft.)	Ord. (ft.)	Total Pal. (ft.)	Year	Total depth (ft.)	Remarks
Conoco-Standard:												
1 Meridian		x	.....	.....	*3,675	*4,255	*2,240	*144	10,314	1950	10,314	Good oil shows in Miss. Chainman fm. and Joana ls. Minor scattered shows in older Pal.
1 Hayden Creek		x	.....	1,586	2,555	976	.....	.....	5,117	1951	5,117	Good oil shows basal Penn. and Miss. Illipah ss.
1 Summit Spring		x	*8,591	*2,394	558	.....	.....	.....	11,543	1952	11,543	Numerous minor oil shows in Perm.
Shell Oil:												
1 E.S.U.	x		.....	900	620	1,025?	.....	.....	2,545	1954	10,358	Produces from Tert. pyroclastics Numerous oil shows in Pal.
15-35 E.S.U.	x		616	Fault?	663	.....	.....	.....	1,279	1955	8,050	Produces from frac. Perm. ls. Oil shows in Miss.
35-35 E.S.U.	x		.....	.....	377	.....	.....	.....	377	1955	7,500	Produces from frac. Tert. limes Oil shows in Miss.
2 E.S.U.	x		.....	.....	.....	28	.....	.....	28	1954	10,183	Good oil shows in Tert.
3 E.S.U.‡	x		.....	.....	.....	789	Fault		844	1954	6,038	Spotty oil staining in Pal.
4 E.S.U.	x		.....	.....	662	591	.....	.....	1,253	1956	7,885	Minor oil shows in Pal.
1 Coyote Unit	x		.....	.....	.....	419	.....	.....	419	1955	1,711	Hot water at 1,700 ft.
1 Diamond Valley	x		.....	.....	.....	557?	.....	.....	557	1956	8,042	No shows. Top Pal. 7,485 ft.
Bandini Pet.:												
1 Harris Govt.	x		.....	.....	.....	6	.....	.....	6	1954	5,556	No shows. Top Pal. 5,550 ft.
Gulf Ref.:												
1 Marys R. Fed.	x	x	.....	.....	.....	Age not known		.....	147	1955	6,612	Minor shows in Tert. Volc. at 4,468 ft.
1 Pete Itcaina	x	x?	.....	.....	1,955	.....	.....	.....	1,955	1954	5,465	No shows. Top Miss.? 3,510 ft.
1 Fed.-Dennison	x		2,283	.....	.....	.....	.....	.....	2,283	1954	4,498	No shows. Top Perm. 2,215 ft.
1 Dolly Varden	x?	x	2,863	.....	.....	.....	.....	.....	2,870	1953	3,158	No shows. Top Perm. 295 ft.
1 Wilkins Ranch	x	x	.....	.....	381	.....	.....	.....	381	1954	8,414	Good shows 6,510-6,790 ft. Top Miss.? 8,033 ft.
2 Wilkins Ranch	x		.....	.....	231?	.....	.....	.....	231	1954	4,938	No shows. Top Miss.? 4,707 ft.
1 Thousands Spgs.	x	x?	.....	.....	Age not known		.....	.....	4,000	1954	8,412	Tar staining. Bottomed in Miss.?
Richfield:												
1 Rabbit Creek	x		3,045	1,234	.....	.....	.....	.....	4,279	1956	7,349	No shows? Bottomed in Penn.
1 Scott-Govt.		x	.....	.....	Age not known		.....	.....	1,036	1957	3,386	Numerous oil and gas shows in Tert.
Standard:												
1 County Line	x		.....	405	.....	.....	.....	.....	405	1957	4,850	Good showings of oil in Tert.
U. S. Oil:												
1 Wilson-Fed.		x	800	1,000	.....	.....	.....	.....	1,800	1957	2,020	Oil shows reported 1,457-89 ft.
J. W. Brown:												
1 Wilson-Fed.	?		1,680	1,650	800	.....	.....	.....	4,032	1957	8,507	Good oil shows in Penn.
McCarthy:												
1 Rahas	Grav.?		.....	.....	525?	.....	.....	.....	525	1950	4,125	Oil showings reported in Tert.?
Total Paleozoic footage drilled in Nevada			19,878	9,169	13,002	8,646	2,240	†144	57,715	.....	.....	

*Maximum penetration in one well. †Penetrated top of Upper Ordovician Hanson Creek Dolomite. Did not reach Middle Ordovician Eureka sands. ‡55 ft. Cambrian.

PALEOZOIC WELL-PENETRATION chart of Nevada tests.



CROSS-SECTION of a typical anticline, White Pine County, Nevada. This is county northeast of Eagle Springs Unit (Nye County).

intertongueing with the fine clastic and carbonate rocks along the Utah border, offers the best example of possible stratigraphic accumulations of oil.

Deep drilling not necessary . . . A common misconception of those lacking in knowledge of Great basin geology seems to be that testing the oil potential of the thick Paleozoic section will necessitate deep and expensive drilling. Unlike the Mid-Continent and Southwest areas where deep drilling is often necessary to test the older horizons, wells of relatively shallow depth (6,000 ft. to 10,000 ft.) will be sufficient to test the lowermost objectives of a number of known structures in areas where the Upper Carboniferous and the Permian have been removed by erosion. An accompanying cross-section is a good example of a large structure where the older sediments can be tested at reasonable depth. This section is represented over most of eastern Nevada with no great thickness or lithologic change.

The prime objectives of the Carboniferous and Permian can be penetrated at relatively shallow depth in many areas. However, somewhat deeper drilling will be required in the valley areas, depending upon the depth of valley fill and the objective horizons of the Paleozoic sediments below.

Future potential . . . The geologic history of the Great basin is admittedly complex and will require persistence and imaginative thinking without prejudice to find new oil fields in this potentially important oil province. Considering the discovery in Railroad Valley, the many showings of oil in wells and outcrops throughout widely scattered areas, and the many potentially good structures in the thick sedimentary section, the petroleum possibilities for eastern Nevada are good indeed.

Acknowledgments

The writer wishes to express his gratitude to the Continental Oil Co. for granting permission to prepare and publish this paper and to Continental personnel, particularly K. L. Rathbun, R. B. Haines and W. H. Corey for their assistance and suggestions in writing the manuscript. Special thanks are due A. E. Brainerd, consultant, Denver, for his suggestions and help in the field and for the compilation of stratigraphic data and correlations for the Nevada section, and R. M. Barnes, Continental Oil Co., retired, who initiated the Great basin study more than 11 years ago.

Geologist honored in Wyoming

EDWARD J. BOOS, 76, has been cited for outstanding geological contributions and was presented an honorary life membership in the Wyoming Geological Association in Casper on December 31, 1958.

John S. Wold, president of WCA, made the presentation on behalf of the society.

Boos is a self-taught petroleum geologist without formal schooling in geology. He pioneered many areas unexplored at the time of his investigations. Born and raised in Lockport, N. Y., his early experience included stints as telegrapher, logger, cowboy, miner, and prospector.

His journeys took him to Wisconsin, Wyoming, Montana, Colorado, and New Mexico. An early association with Barney LaDow, Kansas wildcatter, interested him in the search for oil.

Boos' later assignments included surface geologist from the Canadian border to Texas for Irwin E. Stewart, field and district geologist for Phillips Petroleum Co., and consulting and district geologist for Sohio Petroleum Co. in Michigan and Casper. Since 1952 he has been an independent consultant in Casper.

EDWARD J. BOOS receives citation by John S. Wold, president, Wyoming Geological Association.

New strikes spark tristate interest

TRISTATE oil activities included new strikes in Indiana, Illinois, and western Kentucky.

Indiana . . . Ram Oil Co. 1 Pearl Woodburn, NW SW NW 2-2s-9w, 3 miles northwest of Oakland City in Gibson County, was completed on pump for 125 bbl. of oil daily from Jackson sand at 1,354-80 ft. and in the Aux Vases sand at 1,580-84 ft. The Jackson was fractured, and flow from the Aux Vases was natural. This new pool is 2 miles from production.

Illinois . . . Both Christian County and Clay County had new strikes. Consolidated Oil Producing Co. 1 Ostermeier, SE NE SE 5-14n-2w, 4 miles northeast of Edinburg, will test in the Silurian at 1,899-1,904 ft. after a drillstem test at 1,899-1,904 ft. got 1,100 ft. of clean oil.

Ray Hendricks 1 Robert Wells is a new strike in Clay County, 5 miles northeast of Clay City in 26-4n-8e. Pump is being installed for production tests in the Cypress sand. Swabbing got 10 bbl. of oil per hour after fracture at 2,680-96 ft.

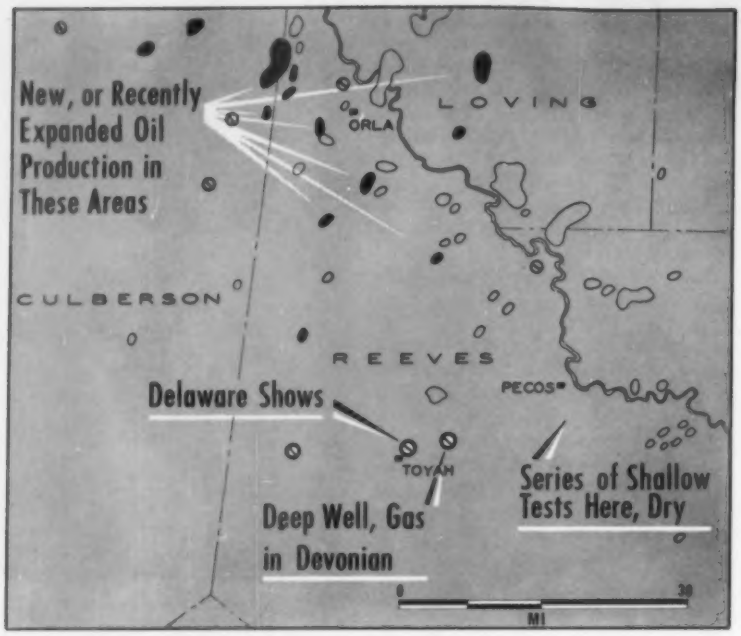
Kentucky . . . Universal Operating Co. 1 J. W. Porter, 20-O-25, 6 miles northeast of Sebree in Henderson County, was completed pumping 185 bbl. of oil per day. Production is from Jackson sand at 1,925-45 ft. This is a new-pay discovery.

Utah gains gas hit

SOUTHEASTERN Uinta basin gas reserves received a healthy addition last week with a big new well at Oil, Inc. 2 Westwater Unit-E, SW SE 7-17s-24e, Grand County, Utah.

This new-pay discovery for the area flowed 7 M.M.c.f.d. of gas on ¾-in. choke from perforations at 5,112-98 and 5,218-28 ft. in Entrada-Upper Jurassic. Through casing on calculated absolute open flow the operator estimates the gas flow at 17 M.M.c.f.d.

Plans are to produce the well in Salt Wash at 4,806-22 ft.; Brushy Basin at 4,602-16 ft.; and Buckhorn at 4,475-95 ft. The gas flows from these three zones (all of which are in the Morrison-Jurassic) were 2,500 M.c.f.d., 6,500 M.c.f.d., and 1,500 M.c.f.d., respectively. The Dakota Cretaceous also indicated production during tests. Nearest production to this big gas well is ½ mile south.



In Texas' Delaware basin . . .

Shallow exploration sets lively pace

SHALLOW EXPLORATION in the north-central portion of Delaware basin continues to come and go faster than mapmakers can spot them on their monthly Texas wildcat-progress maps.

Main objective is the Delaware sand, found anywhere from 1,000-4,000 ft., but here and there a deep well, of 6,000-15,000-ft. depth is drilled. In Texas, the counties getting the shallow play are Culberson, Reeves and Loving. In New Mexico, it's the southern part of Eddy and Lea counties.

Drilling reports for the last week in January tallied the following for Culberson County: Development drilling, equally divided between Geraldine Ford and Screwbean fields, seven locations, five drilling and one in completion stage. In wildcats, locations totaled six, drilling five, and one in completion stage, dry.

In Reeves County the count was seven wildcats drilling, with five in location stage. In development drilling there were 14 locations, 16 wildcats drilling or testing, and 6 in completion stage.

East of Toyah in Reeves County, Gulf Oil Corp. 1 Todd reported a good flow of gas from the Devonian at 13,090-13,160 ft., and just northeast of Toyah townsite, Cree Oil Co., Inc. and Armour Properties 1 Von Trotha had oil shows in the Delaware at 3,905-65 ft.

New pay zone for California's Bridge

DISCOVERY of a new deep zone in the Bridge pool of South Mountain field in Ventura County was confirmed by a Union Oil Co. report it was flowing 800 bbl. daily of 34.9°-gravity crude.

Production is coming from a Pliocene formation below the Oakridge fault at 9,654-10,780 ft. making it the deepest zone in the pool. The regular producing zone in the pool was also found by the Union test, 1 Hill, at 8,780-9,450 ft.

It has been perforated and is being put on production. Total depth of the well in NW NE 22-3n-21w is 11,193 ft. Union had a second well under way in the lease block.

Two wells set for San Bernardino

Plans to drill two more wells in the 11-well Mahala field in San Bernardino County were disclosed by General Petroleum Corp. General Petroleum purchased the field from James Michelin and associates last November for $1 million.

The field is located on a ridge within a 930-acre lease. Drill sites for the latest pair of wells haven't been selected yet, General Petroleum said.

New pay hit for Sooner's Enville

NEW-PAY production is indicated in southern Oklahoma's Enville field, Love County. Sinclair Oil & Gas Co. found gas in Viola Ordovician at its 1 Murphy in NE SW SW 29-6s-3e.

The drill hit the Viola at 10,585 ft. Gas showed at 10,621 ft. Drill-stem test has not been taken as yet. This well is next to the Oil Creek Ordovician discovery well in NE NW SW 32-6s-3e. That one made 11 M.M.c.f.d. of gas and 98 bbl. distillate per 1 M.M.c.f. of gas at 10,620-10,722 ft.

Oklahoma's Cimarron gains big producer

Southeast Griggs field, a Cimarron County gas and oil area that has been attracting considerable attention of late, gained a big producer. The Texas Co. dually completed the 1 Ellington in the Oklahoma Panhandle, C SE NE 15-1n-9eCM, extending the field.

Gas flowed open at 46,532 M.c.f.d. after fracture from the Atoka-Pennsylvanian at 4,276-4,325 ft. From the Morrow-Pennsylvanian the well made 2,900 M.c.f.d. This multipay field is located in the extreme southeast corner of Oklahoma's northwestern-most county.

Second gasser for Ohio's Conneaut field

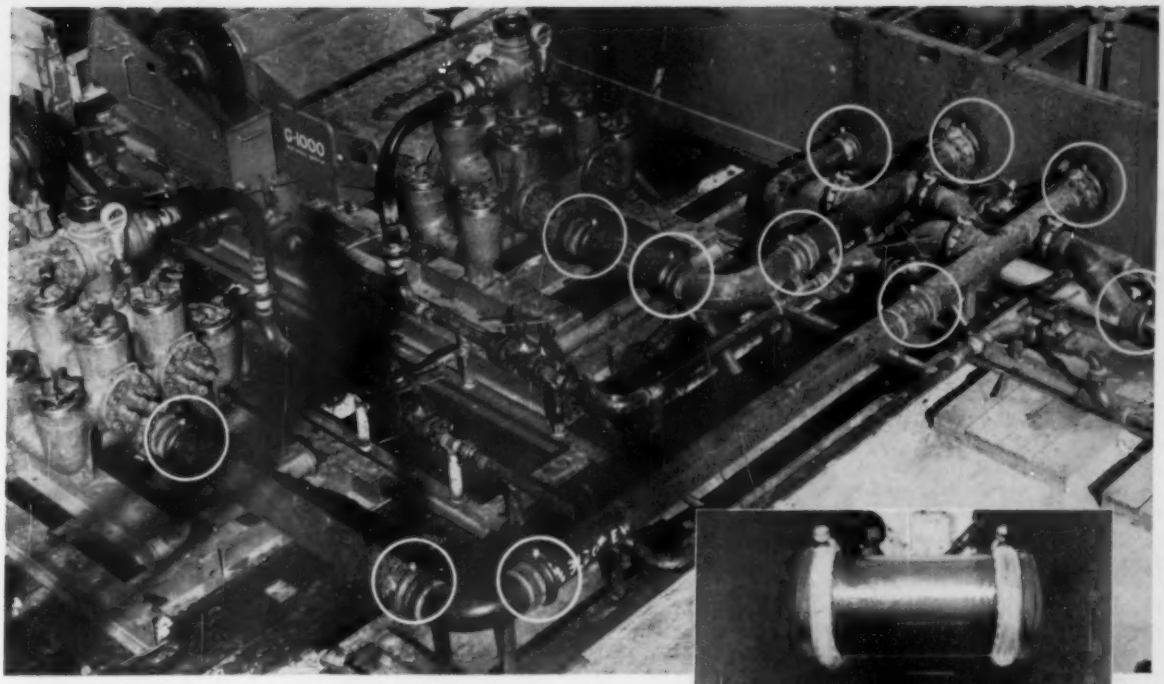
In Ohio Beldon and Blake reported the completion of their second gasser in Conneaut field, a ½-mile step-out to the south of their discovery.

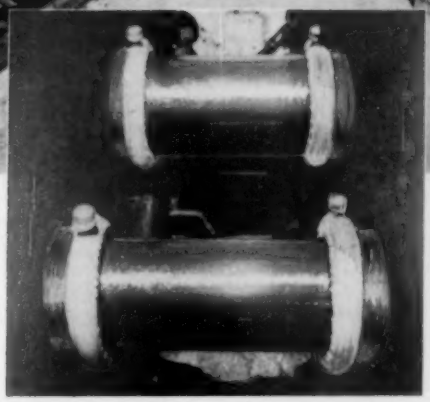
On 1 A. N. Snyder, Lot 6, Seffield Township, Ashtabula County, Clinton was found at 3,060-3,112 ft. with 1 M.M.c.f. natural and 4,500 M.c.f. after fracture.

Logging under way in Washington redrill

Sunshine Mining Co. was running logs in 1 Sampson John Unit, a 4,422-ft. redrill of the old 4 Hawksworth well drilled and abandoned at 3,731 ft. in 1951.

The operator has programed the well to tap the formation producing in Sunshine's 1 Medina, Washington's only oil well.





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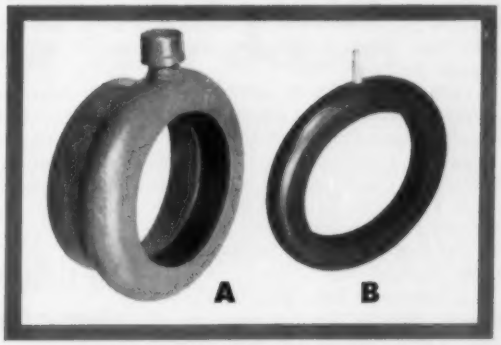

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AO-2-59

Oklahoma drillers speed oil hunt

AFTER SOMEWHAT of a lull in drilling during January, Oklahoma operators are back in the fields in earnest. Wildcatting and development work are forging ahead at a fast clip in all sections of the state, particularly the northwest, central, and south.

Northwest . . . Several gas discoveries, important extensions, and a possible addition to the multipay bonanza at North Buffalo make up the news in the northwestern and Panhandle counties.

In Beaver County, Republic Natural Gas Co. is still testing at a new gas discovery at 1 Jolliffe, C NW SE 30-3n-20eCM. This well, north of Camrick field, made 1,703 M.c.f.d. of gas in the Keyes sand of basal Pennsylvania age at 6,728-38 ft.

. . . North Buffalo. This is perhaps the most promising new oil find in all of northwestern Oklahoma. The field discovery was tabbed the most important strike of 1958 in the state. Production comes from several zones in the Pennsylvanian and in the Cambro-Ordivician.

The newest addition is An-Son Petroleum Co. 1 Miller in C NW NW 8-28n-22w, east of the field in Harper County. Logs found several pay zones in evidence. The Lansing at 4,566-75 and 4,585-99 ft.; the Kansas City at 5,217-30 ft.; the Oswego at 5,419-28 ft.; and the Chester-Mississippian at 5,880-95 ft.; the Simpson had a showing at 7,570-75 ft.; the Arbuckle at 7,598 ft. Free oil was found in the Arbuckle lime at 7,601-65 ft. Recovery was 2,630 ft. of 49°-gravity oil and 790 ft. of mud-cut oil on drill-stem test. This is the pay in the original discovery well.

. . . In Ellis. This northwestern county has another gas discovery area. Pan American Petroleum Corp. completed the 1 Herndon in C SE NW 35-24n-24w, west of Fort Supply gas pool. Flow was 1,714 M.c.f.d. from Morrow-Pennsylvanian sand at 7,988-96 and 8,004-18 ft. Open-flow calculated potential was 1,744 M.c.f.d.

. . . Laverne. This area in Harper County remains the big producer of gas. Cities Service Oil Co. reports another addition to what is becoming an endless list of prolific gassers. The 2 McClung-A, NE NE SW 11-26n-25w, flowed 100 M.M.c.f.d. from Hoover-Pennsylvanian sand at 4,172-97 ft. The Hoover (or Wabaunsee) is the thickest and most prolific of the many sands of Pennsylvanian age in the area. It is a bar 36 miles long and 20 miles wide. Thickness ranges up to 210 ft. Average net effective Hoover pay is 60 ft. at Laverne.

Central . . . One of Central Oklahoma's busiest areas continues to be at East Payne field in McClain County.

Sinclair Oil & Gas Co. extended this Hunton lime field (Siluro-Devonian) at 1 Little-A in C NE NW 16-5n-3w. The well swabbed and flowed 88 bbl. of oil in 12 hours on ¾-in. choke from perforations at 8,561-99 ft.

. . . Grady County. Sun Oil Co. will try for extension of its new field in the West Chitwood area. The 2 Huddleston, NE NW 35-5n-7w, will go to 9,900 ft. for a look at the Hoxbar which was so prolific at the discovery well. That well, Sun-British American 1 Huddleston, SW NE 35-5n-7w, flowed 1,600 bbl. per day from basal Hoxbar at 9,602-30 ft. The new field evidently will be 80-acre spaced.

. . . East Criner. Fain-Porter Drilling Co. moved this field ½ mile east at 1 Steel in C NE NW 28-6n-3w, McClain County. The well flowed 45 bbl. of oil in 1 hour on 22/64-in. choke from Bromide-Ordovician sand at 9,800-10 ft. On 23/64-in. choke it made 37 bbl. per hour. On 22/64-in. choke it flowed 69 bbl. in 1 hour. Down to ⅛-in. choke it made 9 bbl. per hour on average.

South . . . Carter County's West Joiner City field gained a good dual completion with production from the Bois d'Arc section of the Hunton. Frankfort Oil Co. and Carter Oil Co. expect to complete the 1 Curry in SE NW SE 34-4s-3w dually in the Bois d'Arc and Chimney Hill.

Flow from the Bois d'Arc at 7,315-17 ft. was 130 bbl. of oil in 8 hours on ½-in. choke. After acid was used again, it made 25 bbl. hourly, cut 15% acid water. A later gage made 144 bbl. of oil and 36 bbl. acid water in 20 hours on ¾-in. choke. The flow from Chimney Hill was 82 bbl. of oil in 6 hours from perforations at 7,896-7,910 ft.

Wildcatters test remote locations

TWO WILDCATTERS were active testing two California areas not only far from each other but both far from any production.

In northern California's Mendicino County, W. C. Thompson Gas & Oil Exploration Co. was preparing to shoot and test several shallow gas sands encountered in an 878-ft. wildcat located 60 miles from the nearest gas production. This locality is on the southern fringe of the Redwood empire of north coastal California. The drill site is in Redwood Valley about 8 miles north of Ukiah. Mendicino County, while not on the state's list of producing counties, isn't a complete stranger to the drill. As far back as 1925, a wildcatter drilled a 2,174-ft. test about 20 miles northwest of this latest wildcat.

At the opposite end of the state also in nonproductive area, the Mojave Desert, Myron T. King was drilling below 1,790 ft. on a 3,000-ft. test 24 miles northwest of Barstow. Like its northern California counterpart, this area has yet to turn up commercial production, but it has been drilled since before 1925. Nearest production is found about 80 miles west in Kern County.

New Wyoming field keeps expanding

WYOMING'S promising new Robinson Ranch field on the northeast side of the Powder River basin keeps growing. The newest hopeful to this recently opened Pennsylvanian reservoir is Pan American Petroleum Corp.'s 2 Robinson in C SW NE 32-50n-67w, Crook County.

Recovery on drill-stem test in the Minnelusa at 6,137-62 ft. was 1,352 ft. of oil and 210 ft. of mud and water. This is the south offset to the pool discovery.

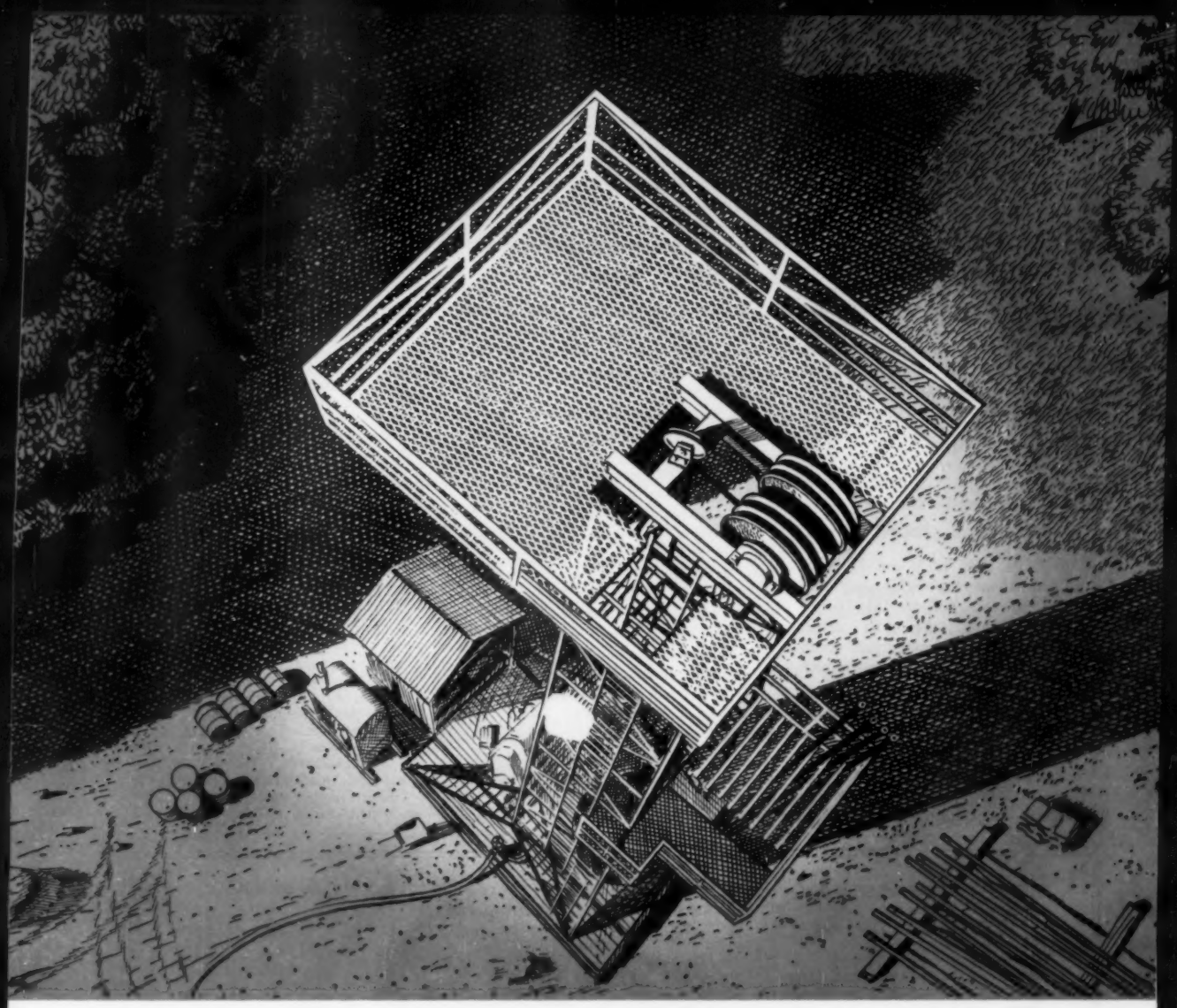
Pan Am is drilling below 6,183 ft. at the well, the field's third. A fourth well, the 3 Robinson in SW SE 29-50n-67w, is busy below 3,256 ft.

Helium production is Arizona target

AN EXPLORATION and development program aimed at finding and producing helium gas from the Coconino formation on a 3,520-acre block of leases near Navajo in Central Apache County of Northeast Arizona is to be started on or about April 1 by Texas American Oil Corp. of Midland.

The 3,520-acre block has not had any tests drilled on it up to now. However, the southeast corner of the acreage is only 3 miles west of the nearest of six shut-in helium gas wells in the Pinta Dome area, owned by Kerr-McGee Oil Industries, Inc., of Oklahoma City which have the highest percentage of helium concentration now known to exist.

It is expected that two helium-gas-producing zones will be encountered by the first Texas American test above 1,100 ft. However, there also are pos-



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sibilities that other pay zones may be found below that level.

The company plans to drill at least one test well to around 3,500 ft. on the block. That depth should reach granite.

The first well on the Pinta Dome structure was drilled in 1950 by Kipling Petroleum, Inc., of Navajo, Ariz.

The major operating interest in that well and in a large spread of leases adjacent to it were acquired in 1951 by Kerr-McGee. That concern drilled and completed five other helium-gas wells on its acreage. All six have been shut in since completion on account of the lack of outlet.

Sooner's Woodward east expansion slated

Woodward field in Woodward County, northwestern Oklahoma, may grow to the east. Union Oil Co. of California located the east offset to the Morrow-Pennsylvanian sand discovery well of this field, just south of the town of Woodward.

Operator will go to 8,500 ft. at the 1 Canfield in NE NE SW 6-22n-20w. The discovery well here was Champlin Refining Co.'s 1 McDonald in C SE NW 1-22n-21w. That well flowed 9,100 M.c.f.d. of gas plus 35 bbl. distillate per 1 M.M.c.f. of gas from lower Morrow sand perforations at 8,256-61 and 8,277-89 ft. The field later was moved one section west by Sinclair.

Oklahoma's Mississippian subject of symposium

The sixth biennial symposium on geology, with emphasis on Oklahoma's Mississippian system, will be held at the University of Oklahoma, February 24 and 25.

The symposium is sponsored by the O. U. geological school and the department of business and industrial services of the O. U. extension division. Chairman is Dr. Carl A. Moore, O. U. geology professor.

Geological problems that are being encountered in the Mississippian system in Oklahoma and southern Kansas will be discussed, Moore said. Papers are to be presented on problems of stratigraphy, sedimentation, and paleontology, as well as drilling procedures.

Discovery wells

WESTERN CANADA

British Columbia: Triad K-39-D Beatton River, 39-K-94-H-2. Triassic oil discovery. TD 3,791 ft.

F.P.C.-Richfield 1 North Diaber, 76-D-94-B-16. Triassic gas discovery. TD 5,670 ft.

Alberta: Shell-Calalta 6-12-6-3 Carbondale, LSD 6, 12 6-3w5. Devonian gas discovery. TD 14,027 ft.

Shell 6-36-4-2 Waterton Park, LSD 6, 36-4-2w5. Mississippian gas discovery. TD 14,032 ft.

LOUISIANA OFFSHORE

Marsh Island Area: The Texas Co. 1 State Lease 340-Lighthouse Point, Southwest Marsh Island Area, Gulf of Mexico, off Iberia Parish. Flowed ungaged volume gas and condensate, perf. 11,520-27 ft. and 11,341-59 ft., squeezed perforations, standing as potential gas-condensate well. TD 12,235 ft. New offshore field.

Ship Shoal Area: Continental Oil Co. (CATC operator) 1-A OCS-0594, Blk. 199 Ship Shoal Area, Gulf of Mexico, off Terrebonne Parish. IP 291 BOPD. 270 M.c.f. per barrel, 10/64-in., 34°, TP 1,905 psi., perf. 9,981-86 ft., and 321 BOPD, 212 M.c.f. per barrel, 10/64-in., 35.2°, perf. 9,901-06 ft. TD 12,914 ft. New offshore field.

Vermilion Area: Superior Oil Co. 3-B OCS-0249, Blk. 76, Vermilion Area, Gulf of Mexico, off Vermilion Parish. IP 6,634 M.c.f.d., 13.96 BOPD, 22/64-in., 44.4°, TP 2,666 psi., perf. 9,086-94 ft., 9,100-20 ft, and 9,128-38 ft. TD 9,500 ft. New pay in Vermilion Blk. 76 field.

California Co. 1 OCS-0433, Blk. 178, Vermillion Area, Gulf of Mexico, Vermilion Parish. IP 2,735 M.c.f.d., 20 BOPD, 14/64-in., 50.4°, TP 3,000 psi., perf. 7,140-74 ft. TD 9,700 ft. New pay and first gas production in Vermilion Blk. 164 field.

West Delta Area. Gulf Oil Corp. 2 Louis-

This announcement is neither an offer to sell nor a solicitation of offers to buy any of these securities. The offering is made only by the Prospectus.

NEW ISSUE

January 28, 1959

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Lazard Frères & Co. — Lehman Brothers — Merrill Lynch, Pierce, Fenner & Smith Incorporated

Paine, Webber, Jackson & Curtis — Smith, Barney & Co. — Dean Witter & Co.

iana State "PP" 192, Blk. 25, West Delta Area, Gulf of Mexico, Plaquemines Parish. IP 446.48 BOPD, 9/64-in., 30.9°, TP 2,850 psi., perf. 10,122-37 ft., and 242.52 BOPD, 10/64-in., 26.5°, TP 1,350 psi., perf. 8,039-46 ft. TD 12,550 ft. Second well, and new pays in West Delta Blk. 25 field.

SOUTH LOUISIANA

Acadia Parish: California Co. and Monterey Oil Co. 1 Ophelia G. LeBlanc, 39-11s-2w. IP 294 BOPD and 5,425 M.c.f.d., 6/64-in., 51.8°, TP 6,250 psi., perf. 14,748-68 ft. TD 15,005 ft. New gas-condensate reservoir 1¼ miles south of South Mermentau field.

Allen Parish: Beck Oil Co. 1 Sonnier, 1-5s-4w, 2 miles northeast of Northwest Oberlin field. Shut-in gas well, no gage, perf. 9,094-9,108 ft. TD 9,518 ft. New field.

Terrebonne Parish: Olin Gas Transmission Corp. et al., 2 School Board et al., 16-18s-17e. IP 4,500 M.c.f.d., condensate yield ungaged, 14/64-in., TP 4,200 psi., perf. 11,813-28 ft. TD 12,568 ft. New pay in Sunrise field.

MICHIGAN

Jackson County: Turner Petroleum Corp. 1 Blair, SE NW SW 20-4s-3w, Pulaski Twp., 5 miles northwest Scipio field. IP 265 bbl. 42.1°-gravity oil, 22 hours, 400 M.c.f. gas, 640 psi. Elev. 1,011 ft., Bass Island 1,950 ft.. Salina 1,995 ft., A-2 dolomite 2,280 ft., Trenton 3,672 ft., gas 3,776 ft., oil contact 3,820 ft. TD 3,832 ft. New oil pool.

MONTANA

Fallon County: Shell et al. 12-23 NP, C SW NW 23-9n-58e. IP 218 BOPD, 13 BWPD, 30.8°, Silurian 8,400-8,506 ft. TD 9,175 ft. Opens Monarch area pool.

Glacier County: Salt Dome Producing Co. 1 Krueger et al., 12-37n-5w. IP 126 BOPD, 28.4°, Madison 2,728-40 ft. TD 2,740 ft. New pay discovery.

NEBRASKA

Banner County: Brinkerhoff Drilling Co. 1 Barrett "C", C SW NE 33-17n-56w. IP 277 BOPD, "J" sand 6,671-81 ft. TD 6,750 ft. Opens Barrett field.

Miracle-Fifer 3 Singleton, NW SE 18-17n-53w. IP 360 BOPD, "J" sand 5,651-61 ft. TD 5,706 ft. Opens Singleton field.

Pan American 5 Johnson, C NW NE 29-18n-56w. IP 145 BOPD, 6% basic sediment and water, "D" sand 6,584-92 ft. TD 6,812 ft. New pay in field.

Kimball County: Shoreline Petroleum Co. 1 Hawthorn, NW SE 23-13n-55w. IP 100 BOPD, 24 BWPD, "J" sand 6,284-88 ft., 6,303-05 ft. TD 6,315 ft. Opens Hawthorn pool.

Sunburst Petroleum Co. 1 Farrell, C SE NE 34-13n-54w. IP 65 BOPD, 7 BWPD, "J" sand 6,084-90 ft. TD 6,155 ft.

Petroleum 2 Hoffman, 21-14n-57w. IP 73 BOPD, 6,968-74 ft. TD 7,059 ft. Opens Hoffman field. Tom Palmer 1 Forsling, C. NE NW 7-14n-56w. IP 245 BOPD, 38°, "J" sand 6,679-88 ft., 6,690-92 ft. TD 6,708 ft. Opens Forsling field.

Palmer 2 Linn-Nuggent, C NW NW 31-15n-56w. IP 56 BOPD, 38°, 6,556-62 ft. TD 6,615 ft. Opens Nuggent field.

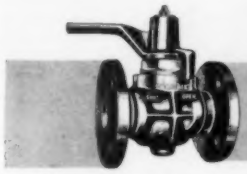
NEW MEXICO

Lea County: Continental Oil Co. 1-19 Bradley-Federal, 19-26s-34e, 20 miles southwest of Jal. IPP 38 BOPD, 39°, GOR 292:1, pay 5,302-08 ft. TD 5,370 ft.

Rio Arriba County: El Paso Natural Gas Co. 67 Jicarilla-5D, SE SW 29-25n-5w. IP 4,683 M.c.f. gas, TP 1,257 psi., Dakota 6,981-7,084 ft. TD 7,215 ft.

EAST TEXAS

Van Zandt County: R. J. Caraway 1 W. E. West, James Boslyne Sur., A-43, 5 miles east of Myrtle Springs. IP 15 M.M.c.f. gas, estimated open flow, Smackover 12,204-12,435 ft. TD 12,754 ft., elevation 493 ft. New pay discovery in Fruitvale field.



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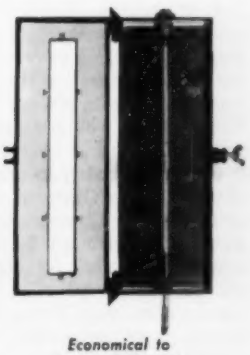


Economical to Buy and Operate

Lane Ready to Lead Battle

. . . against West Coast attacks on oil industry. New head of WOGA hits back on smog question and tax proposals.

IT IS PRETTY generally agreed that 1959 could be a rugged year for California operators.

Politicians are leveling their guns on the state's industry as never before, both in terms of further restricting its operations and increasing its tax burdens.

It will be the job of Olen Lane, newly elected president of the Western Oil and Gas Association, to carry the California oil industry's banner into the legislative wars of 1959.

WOGA members couldn't have picked a more qualified man. The role requires a solid California oil industry background and the toughness of an infantry officer to hold the line. Lane qualifies in both casas.

Lane, vice president and regional general manager for Continental Oil Co. on the West Coast, leaves no doubt about what the association's targets should be in 1959:

"They are the capricious, irresponsible, and discriminatory attacks on the petroleum industry by politicians," he declares emphatically. Lane is referring to three big problems:

. . . **A state severance tax** has been proposed for oil and gas production. This would be tacked on top of a stiff ad valorem or mining-rights tax already on the books.

. . . **Percentage depletion** is expected to get its annual congressional kicking around. Under Lane's leadership, WOGA will continue to play an active part in preserving the present law.

. . . **Attacks are continuing** against the industry in connection with the smog problem in Southern California.

Olen Lane
. . . high costs and double taxation.

Lane's views . . . He leaves no doubt about where he stands on the three big problems.

On the severance tax: "As far as I know, if such a law is passed, California will be the only large oil-producing state with both an ad valorem tax on oil in place, and a severance tax on the same oil as it is produced.

"It would amount to double taxation and would most certainly bring about a higher cost of petroleum products to the consumer."

On the depletion allowance: "If this is tampered with, it will have the direct effect of increasing the people's cost of living.

"A vote for decreasing it would not only dry up the risk capital needed to maintain U. S. oil reserves, but would be a vote for an increase in the cost of living.

"The greater the cost of maintaining U. S. oil reserves the greater the cost to the consumer of a gallon of gasoline at the service station. It's that simple."

On the smog issue: "The county politicos' attacks on the petroleum industry are unwarranted and diversionary and are nothing more than inadequate substitutes for constructive, scientific, and factual action."

Lane says the petroleum industry is an anxious as anyone to have a smogless California and always has been ready to cooperate in restoring clean air to California.

"Because of the inefficiency of existing automobile exhaust systems and of the atmospheric conditions overlying the Los Angeles Basin, smog will never be eliminated until the problem

▶ ▶ ▶ Personals

J. F. (Jerry) Carter, formerly with Pan American Petroleum Corp., has joined Rupp-Ferguson Oil Co. as petroleum engineer. He will headquarter in Wichita.

J. W. Brown, Roswell, N. M., district engineer for Pan American Petroleum Corp., has been named field superintendent for the Hobbs, N. M., producing area. He succeeds **R. L. Hendrickson,** who has retired.

Ralph S. Fowler, formerly assistant director of the Office of Oil and Gas of the Interior Department, has joined Pure Oil Co. He will be in charge of a new department for foreign crude-oil purchases and sales with headquarters in New York. Fowler is a former vice president of Arabian American Oil Co.

Charles Hornberger, geologist with Sun Oil Co. in Maracaibo, Venezuela, is moving to Caracas to set up a scouting section for the company.

Forrest S. Warren, formerly vice president and manager of the Gulf Coast division for Texas Natural Gasoline Corp., has been named president and a director of Texas Petro Gas Co., new Houston firm.

C. B. Branch, manager of Dow Chemical Co.'s plastics department and a director of the company, has been named manager of all Dow overseas and foreign activities except those in Canada and Mexico. He becomes president of Dow Chemical International, S.A., a recently formed subsidiary. **Dr. W. C. Goggin,** manager of plastics technical service, will succeed Branch as manager of the plastics department. Branch had held this post since 1952.

J. C. Osborne, mechanical design engineer in Atlantic Refining Co.'s engineering and construction department in Dallas, has been promoted to district engineer and transferred to Corpus Christi, Tex.

Oren B. Gambill, administrative assistant in the geological department of Sinclair Oil & Gas Co., has been named executive assistant in the executive department. He succeeds **F. G. Schmidt,** who has retired.

Dr. Hans P. Schaub will become Shell de Venezuela's exploration manager in Caracas in April, replacing **Paul Schoorel,** who is retiring. Schaub is now with the Maracaibo exploration group. **R. G. H. Mackilligan** will head the company's planning, organization, and methods group in Maracaibo. He will be succeeded as head of the production department in Caracas by **John Dixon.**

is divorced from the pressure of the local political arena and until automobiles are equipped with an effective after-burner exhaust device."

Transplanted Sooner . . . Like so many California oil executives, Lane is a transplanted Oklahoman.

He was born in Indian Territory in what is now Pontotoc County in 1896 and received his early schooling in Shawnee. His studies at Oklahoma A & M College were interrupted by World War I. He was released from active duty after the armistice as a captain in the infantry.

In 1920, he joined Marland Oil Co.'s land department in Ponca City. In 1923, he was transferred to California as vice president of Marland Oil Co. of California, in charge of the state's exploration activities. After Continental and Marland merged, he later became vice president and regional general manager of Continental's western region.

Lane has played a leading part in some of the state's biggest discoveries. He put together the land picture and promoted drilling the well which resulted in discovery of Kettleman Hills field. He also played key roles in discovery of such other California fields as Seal Beach and San Miguelito.

The Lanes are 30-year residents of suburban Glendale where Lane served as assistant chief of police (auxiliary) during World War II.

Lane has been first and second vice president of WOGA and a director and president of the Los Angeles Petroleum Club. He is also a member of API and the California Club.

Eugene L. Mikolajczyk, petroleum-engineer trainee with Magnolia Petroleum Co. in Healdton, Okla., has been promoted to junior production engineer and transferred to Duncan, Okla.

E. C. Taber, Jr., Shell Oil Co. Tulsa area geologist, has been given a special assignment with Shell Development Co. in Houston. **J. H. Pittinger,** North Texas division exploration manager in Wichita Falls, will succeed Taber. Pittinger will be replaced in Wichita Falls by **J. F. Bookout,** Amarillo, Tex., district geologist. Bookout has been on special assignment in New York. **J. C. Threet,** Oklahoma City geologist, has been transferred to Amarillo as district geologist. Also, **R. R. Evans,** eastern district geologist in the Oklahoma division, has been temporarily assigned to Amarillo. **R. R. Hillery** will succeed Evans as eastern district geologist.

Alfred B. Hill, division supervisor for American Oil Co. in Destrehan, La., has been transferred to Texas City as engineering coordinator.

Irvin H. Delatte, production engineer with Continental Oil Co. in Ville Platte, La., has been transferred to Eunice, La., in the same capacity.

H. D. Becwar, Houston division geologist for The Texas Co.'s domestic producing department, has been promoted to assistant manager of the Denver division.

Don D. Smith, Jr., production engineer in La Habra, Calif., for Standard Oil Co. of California, has been transferred to San Francisco as reservoir engineer.

Jack W. Stackpole, formerly Corpus Christi, Tex., district landman for Lion Oil division of Monsanto Chemical Co., has been named special representative to coordinate foreign and domestic crude-oil sales. He will headquarter in Houston.

Robert C. Honea, staff geologist for Tennessee Gas & Oil Co., new subsidiary of Tennessee Gas Transmission Co., has been named chief geologist. **Vernon T. Bolleter,** Corpus Christi, Tex., district geologist, has moved to Bellaire, Tex., as district exploration manager. **R. R. Brillhart** has been promoted from district geologist to district exploration manager at Lafayette, La. Also, **C. S. Algire, Jr.,** geologist in Durango, Colo., has been promoted to Denver district geologist. **Henry C. Dean,** geologist, has been named district geologist at Bellaire. **James J. Bollich,** geologist senior, becomes district geologist at Lafayette.

O. W. Chonetts, The Texas Co., has been elected president of the Petroleum Production Pioneers, Glendale, Calif. **John Cody,** former vice president of Superior Oil Co., has been named honorary president. **E. (Pick) McIver,** consultant, is vice president, with **Alex Robertson,** Alex Robertson Co., as honorary vice president. Other officers are **Douglas A. Kingman,** General Petroleum Corp., treasurer; **Paul Andrews,** Signal Oil & Gas Co., historian; **Floyd Vaughn,** Halliburton Oil Well Cementing Co., sergeant-at-arms; and **Richard Sneddon,** Petroleum Club of Los Angeles, secretary. Directors include McIver, Robertson, **H. D. Aggers,** Union Oil Co.; **J. R. B. Freeman,** Bethlehem Steel Co.; **John B. Isaacs,** Hillman-Kelley; **John O. Hills,** General Petrolem; and **R. C. Schweitzer,** Signal Oil & Gas Co.

▶ ▶ ▶ Personals

BYRD

EDWARDS

RAGLAND

HOCOTT

Humble Oil & Refining Co. has named four men to new management posts in a reorganization of its production department. They are **L. H. Byrd,** operations manager; **J. O. Edwards,** administrative services manager; **Douglas Ragland,** engineering manager; and **Dr. C. R. Hocott,** research manager. The new managers will report to **R. C. Barbour,** manager of the production department. Byrd has been assistant superintendent of Humble's western production division at Midland, Tex., since 1954. Edwards was formerly assistant controller. Ragland was formerly chief petroleum engineer. Hocott had been head of the production research division since 1956.

Appointment of the four managers sets off other production department changes. **T. A. Huber,** assistant chief petroleum engineer, moves up to chief engineer, succeeding Ragland. **William McCardell,** research specialist, has been named chief research engineer. Huber, inventor of Humble's permanent well-completion method, has been with the company since 1928. McCardell joined Humble in 1949.

HUBER

Hal H. Bybee, senior geologist in Continental Oil Co.'s CATC marine region, has been promoted to CATC regional geologist. He will continue to headquarter in Houston. Bybee succeeds **R. M. Dungan,** who was recently transferred to Los Angeles.

Tom Ashe of Globe Oil Tools named Los Angeles Nomads president

Tom Ashe, Globe Oil Tools Co., first row, second from right, is new president of the Los Angeles chapter of Nomads. New and outgoing officers of the group include, first row, left to right, Earl R. Atkins, Devex Engineering Co., outgoing vice president; Robert P. Gaylord, Wagner-Morehouse Inc., senior regent; Earl M. Daniels, Hydril Co., outgoing president and new junior regent; Ashe; and Harry Hester, McCullough Tool Co., outgoing senior regent. Also, second row, left to right, Leo Cypher, Baash-Ross Tool Co., secretary; Andy Anderson, Pacific Perforating Co., sergeant-at-arms; C. F. Van Loozen, Power Rig & Equipment Co., outgoing treasurer; Taylor Bannerman, Technical Oil Tool Corp., vice president; Charles M. King, Baker Oil Tools, Inc., assistant secretary; P. M. (Shorty) Bowen, Martin-Decker Corp., assistant treasurer; Arthur S. Marshall, H. C. Smith Oil Tool Co., deputy sergeant-at-arms; and Knight Templeton, S. R. Bowen Co., treasurer. Officers were elected at a recent business meeting.

William H. Rader, assistant polyethylene production manager for U. S. Industrial Chemicals Co., has moved up to manager.

Justin C. Crawford has been promoted to head engineer in the Whiting, Ind., engineering administration department of Standard Oil Co. (Ind.).

WEEKS

Lewis G. Weeks, Westport, Conn., consulting geologist, has been elected president of the American Association of Petroleum Geologists. Outgoing president is **Geo. S. Buchanan,** Husky Oil Co. Other new officers include **Alfred H. Bell,** Illinois State Geological Survey, vice president; and **Grover E. Murray,** Louisiana State University professor, editor. **Harold T. Morley,** Pan American Petroleum Corp., was re-elected secretary-treasurer. The new officers will be installed during the AAPG annual meeting in Dallas March 16-19.

Dr. A. D. Cumming, chief geologist for Tidewater Oil Co., operator, in the Saskatchewan project of Tidewater and three other companies, has been named assistant manager of the project. He succeeds **Dr. R. L. Milner.** Tidewater's partners in the operation are Atlantic Refining Co., Columbian Carbon Co., and Ohio Oil Co.

Paul J. Shanor, formerly division engineer with Bradley Producing Corp., has formed Shanor Engineering, Tulsa consulting firm. Shanor was with Illinois State Geological Survey before joining Bradley Producing in 1953.

E. E. Powell, section head and manager of the Pittsburgh office of Esso Research & Engineering Co., has been named vice chairman of the American Petroleum Institute's committee on standardization of tubular goods and chairman of the API user subcommittee on line pipe. He succeeds **Robert G. Strong,** Natural Gas Pipeline Co. of America, who has retired. **Carl Dawson,** Standard Oil Co. of California, has been named vice chairman of the committee on standardization and a chairman of the users committee on casing, tubing, and drill pipe.

Five executives at the Whiting, Ind., research laboratories of Standard Oil Co. (Ind.) have been given new assignments. **Arthur L. Conn,** head of process design and economics division, has been named head of technical service. **Robert A. Steele,** director of process development, will head process design and economics. Steele will be succeeded by **William F. Meehan,** who has been superintendent of technical service. **Clarence M. Loane,** formerly director of lubricants research, and **Glenn M. Webb,** director of hydrocarbon research, will switch jobs.

John Beckwith, group head in Esso Research & Engineering Co.'s operations research section, has been named section head.

Dr. Herbert C. Walther, Jr., has been appointed research engineer in Continental Oil Co.'s production research division. He will headquarter in Ponca City, Okla.

Robert F. Dudley, assistant traffic manager of Standard Oil Co. (Ohio), has been promoted to manager of the new traffic division. **Ray Elo,** manager of the company's Latonia, Ky., refinery, will take a temporary assignment as head of the new distribution division. The two divisions were formed through separation of operations in the supply and distribution department.

R. L. Ferris, New Orleans division exploitation engineer for Shell Oil Co., has been transferred to the Midland, Tex., area as chief exploitation engineer. He succeeds **E. N. Durham,** who recently became special assistant to the production manager.

John T. Hayward, president of Hayward-Wolff Research Corp., Clearwater, Fla., has been awarded the Anthony F. Lucas Gold Medal of AIME. Hayward will be cited for his practical application of scientific principles to drilling and production problems and for his design of offshore drilling equipment. The award will be presented at AIME's national convention February 15-19 in San Francisco.

▶ ▶ ▶ Personals

BOHART

P. H. Bohart, vice president in charge of Gulf Oil Corp.'s planning and economics department, has been named vice president and coordinator of the crude-oil department. He is also chairman of the company's crude-oil council and a representative on the administrative committee. Gulf has also named **V. H. Ludwig,** director of employe relations, vice president in charge of organization planning and employe relations. Ludwig has been with Gulf since 1920. Bohart joined the company in 1919. He was general manager of Gulf's Mexican operations at one time and later was vice president of several subsidiary companies. During World War II he served as director of production for the Petroleum Administration for War. He was named vice president in charge of the Tulsa production division in 1950 and vice president in charge of planning and economics in 1956.

Charles Pennypacker Smith, manager of operations for Alberta & Southern Gas Co., Ltd., has been elected vice president and manager and a director of the company. He succeeds **J. K. Horton,** who will become president of Southern California Edison Co. Smith also becomes vice president and manager of Alberta Natural Gas Co. Alberta & Southern and Alberta Natural are subsidiaries of Pacific Gas & Electric Co.

Robert M. Thomas and **John F. Kunc** have been appointed senior research associates by Esso Research & Engineering Co. Thomas, coinventor of butyl rubber, has been assistant director of the chemicals research division since 1955. Kunc has been in charge of long-range research on fuels and nuclear applications in the products research division.

W. J. Magers, formerly operating assistant at Sun Oil Co.'s Marcus Hook, Pa., refinery, has been appointed general superintendent of SunOlin Chemical Co.'s proposed urea plant near Marcus Hook. The plant is schedu'ed for completion in late 1959. While it is under construction Magers will act as an operating consultant to the SunOlin engineering group.

Leonard C. Swing, construction superintendent for Hope Natural Gas Co., has been promoted to vice president for engineering, and a director of the company. **Walter M. Kinley,** executive assistant to the president of Hope, has been promoted to vice president for administration, and a director.

Robert E. Kepke, president of British-American Oil Producing Co., has been e'ected president of the Dallas Petroleum Club. He succeeds **C. H. Alexander,** Dallas independent.

Harold Hoyt, chief mechanical engineer for Great Lakes Pipe Line Co., has been promoted to assistant chief engineer. **Roy James,** formerly safety director, has been named assistant to the manager, operating division. Hoyt will be succeeded as chief mechanical engineer by **John Fulkerson,** formerly assistant to the chief engineer. **C. D. Zickefoose,** terminal superintendent at Sioux Falls, S. D., has replaced James as safety director.

Jed B. Maebius, senior geologist with Tidewater Oil Co., has been promoted to central division exploration manager in Tulsa. Maebius joined Tidewater in 1957 in California after 20 years in Gulf Oil Corp.'s exploration department. He was chief geologist and assistant manager in Gulf's Tulsa division at one time.

John Bartlett, The Texas Co., has been elected president of the Liberal, Kans., Geological Society. Other new officers include **Clifford Holloway,** Lion Oil division of Monsanto Chemical Co., vice president; **Dick Zimmerman,** Petroleum, Inc., secretary; and **Louis Chubb,** Panhandle Eastern Pipeline Co., treasurer.

Pieter Root, Jr., assistant manager of the Pacific Coast branch laboratories of American Gas Association, has been named assistant to the director of AGA laboratories. He will headquarter in Cleveland.

Arthur E. Bowe has been named laboratory manager in the western region office of Du Pont Co.'s petroleum chemicals division, Los Angeles. **Frederick B. Stehr** has been named sales promotion coordinator there.

C. E. (Gene) Gessner, staff assistant engineer with Kerr-McGee Oil Industries, Inc., has been promoted to general superintendent of the natural-gasoline division.

▶ ▶ ▶ Deaths

J. W. C. (Mac) McKee, 52, Grand Rapids, Mich., independent operator, died January 30 after surgery for traffic accident injuries. McKee came to Michigan in 1931 with Oil Well Supply Co. and later was with Franklin Supply Co. and the old Roosevelt Oil & Refining Co. before becoming an independent.

Richard E. Frasch, 51, owner of Apex Equipment Co., died January 25 in Bakersfield, Calif., after a heart attack. Frasch was with Buass Drilling Corp. before forming his own equipment company.

Elmer Roeder, 74, Franklin, Pa., oil producer, died January 28 in Franklin. He had been in poor health for several years.

H. D. Collier, 82, retired president and chairman of Standard Oil Co. of California, died January 30 in a San Francisco hospital. Collier joined California Standard in 1903. He retired as board chairman in 1950 but remained as a director until 1955. He was board chairman of Arabian American Oil Co. and a director of Trans-Arabian Pipe Line Co. at one time.

B. K. Leach, president of Oil Management, Inc., St. Louis, died recently in St. Louis after a heart attack.

Wayne Eugene Larsh, 42, superintendent for G. W. Strake Oil Co. at Winters, Tex., died January 27 from injuries received in a car-truck collision near Robert Lee, Tex.

Gilvie Hubbard, 68, retired attorney with Humble Oil & Refining Co., died January 30 in Houston after a heart attack. Hubbard retired from Humble in 1950 and became a partner in the law firm of Hubbard & Gilmore.

Albert Sheldon Baptie, 58, Wood-Callahan Oil Co., Long Beach, Calif., died February 1 in Long Beach. Baptie was with Shell Oil Co. for 20 years before joining Wood-Callahan.

James G. Park, 62, retired vice president of Enjay Co., Inc., died January 29 at his home in Bronxville, N. Y. Park retired last July after 38 years with Enjay. He had been a vice president since 1938.

▶ ▶ ▶ Statistical Section

Distillate-demand gains boost price

BY JOHN C. CASPER

HIGH DEMANDS and limited supply are creating problems in the distillate market, particularly on the Gulf Coast. Many refiners in the area report that they are booked up for February and are expecting good movement of heating oils over the next 60 days.

Demand increases have been due to colder-than-normal weather for the past 2 months. Distillate demand in the early part of the heating season was running behind the previous year, but a sharp change came in December. Average temperatures were lower than for December 1957 and also lower than normal. Cold weather continued through January. The end result was a big shift in demand for heating oils, starting with December.

Deliveries of distillate fuels broke all previous records for the December-January period. The 2-month average was just a little less than 3,100,000 bbl. daily compared with 2,553,000 bbl. daily a year ago and 2,643,000 bbl. daily for the same months of the 1956-57 winter.

Part of this jump in demand was covered by higher refinery yields of distillate fuels combined with increased runs of crude. The remainder had to come out of storage tanks. The charts at the bottom of the page show stock comparisons for Districts 1, 2, and 3.

District 3 inventories of distillate have been under the previous year since April. Part of this difference was due to abnormal additions to distillate storage in 1957 when export demand dropped, following the reopening of Suez Canal.

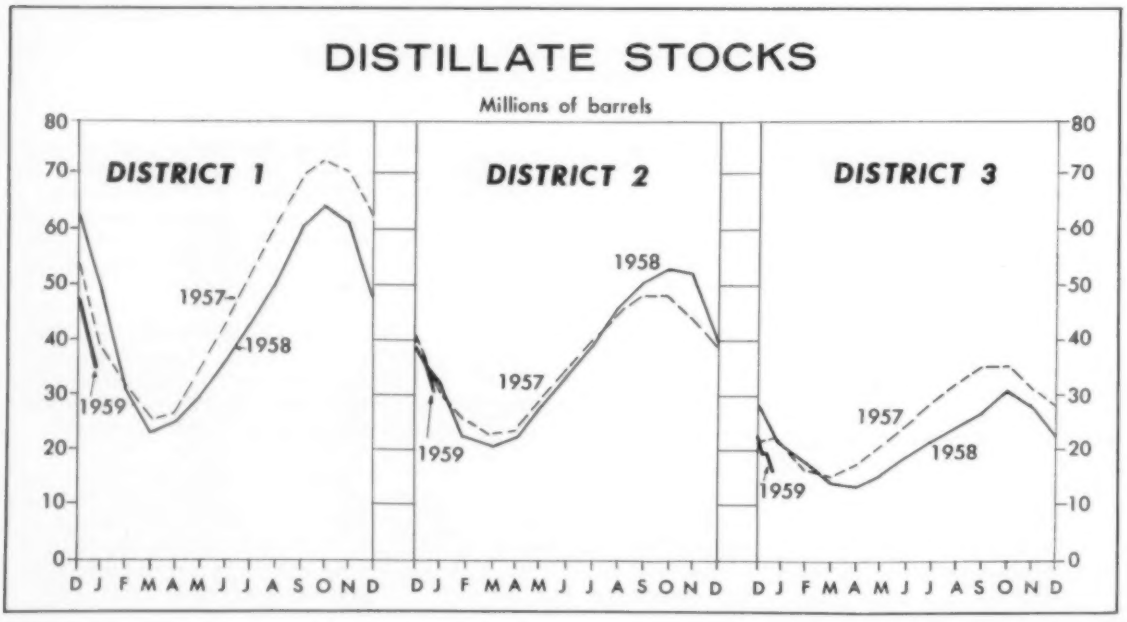
Demand is up and stocks are dropping, and one big refinery is out of the supply picture on the Gulf Coast. The big 270,000-bbl. Gulf Oil Corp. refinery at Port Arthur has been closed by strike. If this plant were running with an input of 250,000 bbl. daily and distillate yields in line with the average for the Gulf Coast, distillate output would be near 500,000 bbl. per week. As long as this plant is closed, its normal distillate production either will be made up by increased production at other plants or will come out of stocks.

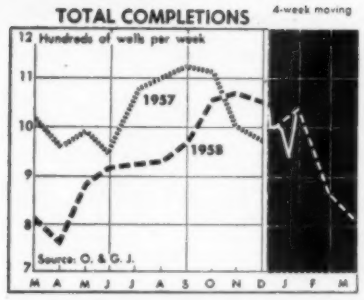
This tight supply-demand balance has boosted distillate prices. Quotations on the Gulf Coast moved up 0.25 cent a gallon at the end of January and the market is very tight. The new price for No. 2 fuel is 9.875 cents a gallon, up 1.25 cents since the start of the heating season but 0.375 cent under the peak reached in February 1957.

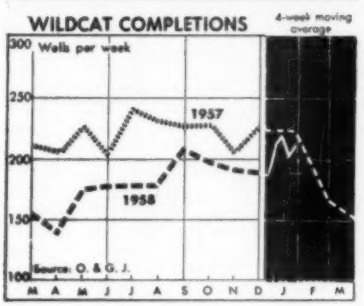
A strike at Shell Oil Co.'s refinery at Wood River, Ill., has cut distillate supplies for District 2. The plant has a crude capacity of about 175,000 bbl. daily and could produce distillate at a rate of at least 40,000 bbl. daily. This reduction plus the drop in upriver movement of distillate will tend to tighten heating oil markets in District 2.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,118,355	DOWN	80,745	UP	329,509
Crude stocks	257,921,000	DOWN	2,213,000	DOWN	18,961,000
Completions	866	DOWN	122	DOWN	134
Refinery runs	8,113,000	DOWN	198,000	UP	565,000
Gasoline stocks	197,511,000	UP	4,628,000	DOWN	7,048,000
Kerosine stocks	20,910,000	DOWN	478,000	DOWN	2,269,000
Distillate stocks	96,745,000	DOWN	3,657,000	DOWN	26,376,000
Residual stocks	57,867,000	DOWN	2,057,000	UP	365,000
Four-product stocks	373,033,000	DOWN	1,564,000	DOWN	35,328,000
Total imports	2,022,800	UP	455,800	UP	243,900







Active Rotary Rigs*

	2-2-59	1-26-59	2-3-58
Alabama	8	8	11
Arkansas	16	7	16
Arizona			1
California	76	79	87
Land	72	74	(†)
Offshore	4	5	(†)
Colorado	22	23	35
Florida	1	1	1
Illinois	20	39	27
Indiana	4	4	....
Iowa	3	3	3
Kansas	118	109	119
Kentucky	5	5	....
Louisiana	305	297	337
North	36	36	32
S.-Inland waters	132	130	(‡)
S.-Land	101	97	234
Offshore	36	34	71
Maryland	2	2	....
Michigan	11	11	6
Missouri	....	....	....
Montana	16	18	28
Mississippi	55	62	42
Nebraska	25	25	15
Nevada	....	....	....
New Mexico	101	100	109
New York	....	....	1
North Dakota	29	29	33
Ohio	2	4	3
Oklahoma	177	176	197
Oregon	....	....	....
Pennsylvania	11	9	10
South Dakota	1	....	1
Texas	692	694	763
S.-Inland waters	7	7	(‡)
S.-Land	146	139	158
Offshore	1	1	4
North-East	154	157	(†)
West Central	251	251	(†)
West	133	139	(†)
Utah	28	28	45
Washington	1	1	....
West Virginia	2	2	4
Wyoming	50	57	53
Total U. S.	§1,781	§1,793	1,947
Western Canada	215	217	226
Eastern Canada	....	....	1
Grand total	1,996	2,010	2,174

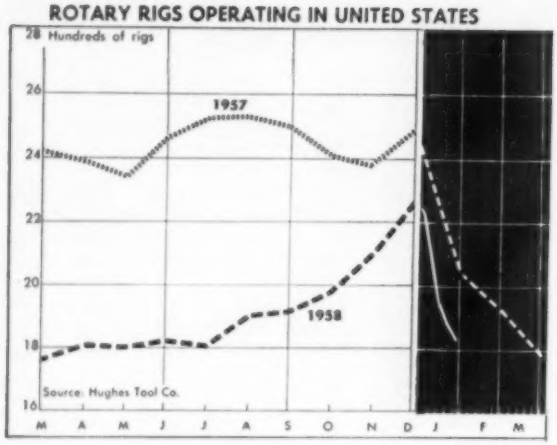
*Hughes Tool Co. †Comparisons not available due to change in method of reporting. ‡Included in South-Land. §Chart shows 4-week averages.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JANUARY 31, 1959

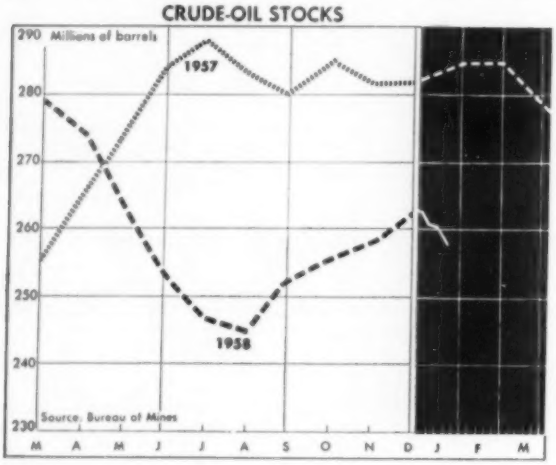
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1959	1958	Total	Crude	Cond.	Gas	Dry	1959	1958
Alabama	3	3	0	0	0	0	34,563	17	8	0	0	0	0	0	2	4
Arkansas	25	20	0	0	5	0	79,953	96	76	2	0	0	0	2	23	15
California	31	21	0	1	9	0	140,704	156	200	7	1	0	0	6	38	33
Colorado	12	1	0	1	10	0	62,842	72	56	5	0	0	0	5	36	28
Illinois	44	22	0	2	20	0	101,566	234	196	6	0	0	0	6	40	43
Indiana	8	4	0	0	4	0	13,998	66	70	3	1	0	0	2	19	26
Kansas	63	29	0	5	27	2	237,446	402	368	17	2	0	3	12	102	84
Kentucky	28	6	0	6	16	0	45,557	150	103	4	0	0	0	4	12	12
Louisiana	69	30	11	5	23	0	525,474	352	339	6	1	0	0	5	55	46
North	23	12	0	3	8	0	64,304	130	118	0	0	0	0	0	26	22
South	40	17	7	2	14	0	405,600	187	177	6	1	0	0	5	28	21
Offshore	6	1	4	0	1	0	55,570	35	44	0	0	0	0	0	1	3
Michigan	18	6	0	0	12	0	45,648	58	30	9	0	0	0	9	20	10
Mississippi	12	8	2	0	2	0	110,065	77	49	3	1	0	0	2	38	26
Montana	4	2	0	0	2	0	23,778	28	45	2	0	0	0	2	7	24
Nebraska	18	5	0	0	13	0	106,840	59	64	7	0	0	0	7	26	31
New Mexico	36	24	2	8	2	0	124,385	146	237	2	0	0	0	2	18	36
New York	0	0	0	0	0	0	0	33	55	0	0	0	0	0	1	5
North Dakota	10	8	0	0	2	0	61,492	39	39	1	1	0	0	0	9	15
Ohio	15	7	0	5	2	1	33,042	66	80	0	0	0	0	0	2	3
Oklahoma	87	42	3	4	36	2	318,546	495	734	15	1	0	1	13	93	112
Pennsylvania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Texas	335	199	11	11	101	13	1,435,124	1,872	1,895	52	4	1	0	47	372	420
District 1	24	13	0	3	8	0	47,892	157	96	6	0	0	0	6	36	35
District 2	9	3	0	0	6	0	62,677	80	64	5	2	0	0	3	24	19
District 3	19	9	2	0	8	0	165,339	105	134	5	0	0	0	5	33	23
District 4	20	5	5	3	6	1	96,869	148	118	5	0	1	0	4	45	43
East	22	14	1	0	7	0	123,986	109	138	2	0	0	0	2	28	47
District 7-B	39	19	0	0	20	0	113,114	236	225	10	1	0	0	9	72	73
West	122	92	1	2	21	6	566,751	576	570	13	1	0	0	12	68	96
District 9	61	29	0	3	23	6	170,886	334	421	6	0	0	0	6	55	71
District 10	19	15	2	0	2	0	87,610	127	129	0	0	0	0	0	11	13
Utah	11	9	0	0	2	0	64,350	33	41	2	0	0	0	2	8	9
West Virginia	15	6	0	7	2	0	32,430	68	54	0	0	0	0	0	2	0
Wyoming	20	4	0	1	15	0	93,324	80	72	10	0	0	0	10	32	34
Misc. (Ariz., Fla.)	2	0	0	0	2	0	11,268	11	14	1	0	0	0	1	8	10
Total U. S.	**866**	456	29	56	307	18	3,702,395	4,610	4,825	**154**	12	1	4	137	963	1,026
Prev. week	988	536	27	62	341	22	3,999,038	.....	.....	176	14	1	5	156	.....	.....
Cum. 1959	4,610	2,296	124	283	1,796	111	19,579,138	.....	.....	963	88	13	31	831	.....	.....
Western Canada	56	30	0	3	23	0	274,915	130	203	20	2	0	0	18	37	61

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	1-24-59	1-17-59	1-25-58
Pennsylvania	2,517	2,584	2,905
Other Appalachian	1,476	1,485	1,631
Illinois, Indiana, Michigan	9,605	10,190	11,038
Nebraska and North Dakota	2,205	2,208	2,754
Kansas	9,522	9,652	10,032
Oklahoma	16,665	16,705	19,025
Arkansas	2,144	2,105	2,519
Louisiana	17,033	17,423	19,465
North	3,059	3,140	3,035
South	13,974	14,283	16,430
Mississippi, Alabama, Florida	2,472	2,364	2,429
New Mexico	9,075	8,684	9,162
Texas	115,171	115,419	121,914
East Texas	8,426	8,278	9,074
West Texas	56,335	56,722	53,987
Texas Gulf	20,258	20,095	24,987
Other Texas	30,152	30,324	33,866
Wyoming	13,553	13,853	13,812
Other Rocky Mountain	9,201	9,420	6,494
California	34,004	34,037	37,074
Foreign	†13,278	14,005	16,628
Total	**257,921**	260,134	276,882

*Bureau of Mines. †Includes 4,115,000 bbl. in California.

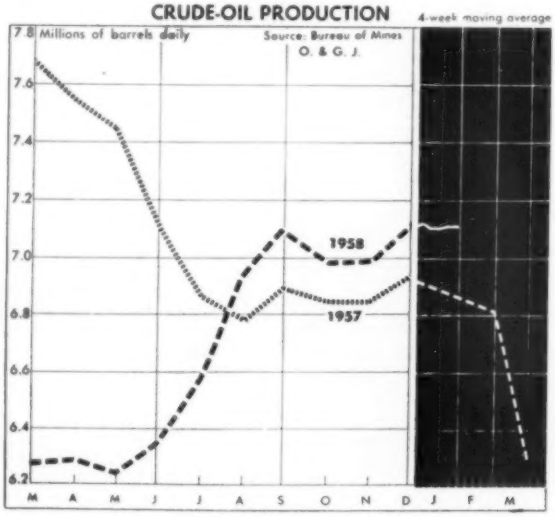
DAILY AVERAGE PRODUCTION FOR WEEK

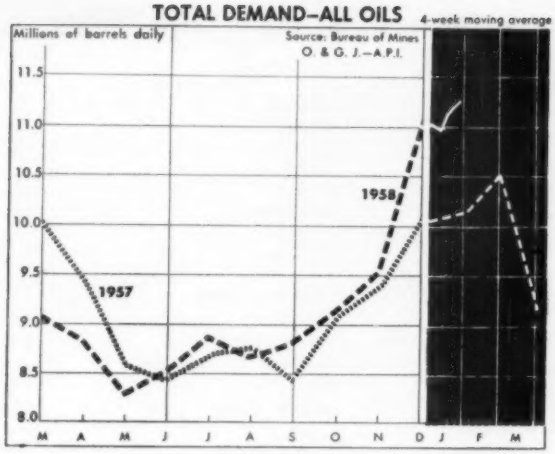
	January 31, 1959			Jan. 24
	Crude oil	Lease condensate	Total	total
Alabama	15,415	.....	15,415	15,675
Arkansas	77,050	150	77,200	81,375
California	850,100	.....	850,100	851,300
Colorado	128,000	.....	128,000	128,100
Eastern	39,800	.....	39,800	40,400
Florida	1,200	.....	1,200	1,200
Illinois	219,400	.....	219,400	§226,400
Indiana	32,100	.....	32,100	§32,300
Kansas	†314,890	.....	†314,890	†342,875
Kentucky	64,500	.....	64,500	63,500
Louisiana	836,000	101,975	937,975	938,000
North	111,500	3,975	115,475	115,500
South	724,500	98,000	822,500	822,500
Michigan	24,700	.....	24,700	§25,800
Mississippi	115,100	5,250	120,350	120,350
Montana	78,000	.....	78,000	78,400
Nebraska	59,200	.....	59,200	59,000
Nevada	100	.....	100	100
New Mexico	275,000	6,400	281,400	281,400
North Dakota	38,000	.....	38,000	37,200
Oklahoma	†545,900	.....	†545,900	†587,100
Texas	2,778,000	68,400	2,846,400	2,846,400
Dist. 1	43,000	1,600	44,600	44,600
Dist. 2	120,000	8,500	128,500	128,500
Dist. 3	383,000	33,500	416,500	416,500
Dist. 4	197,000	7,600	204,600	204,600
Dist. 5	31,000	500	31,500	31,500
Dist. 6	122,000	7,400	129,400	129,400
East Texas field	161,000	.....	161,000	161,000
Dist. 7-B	142,000	150	142,150	142,150
Dist. 7-C	140,000	3,850	143,850	143,850
Dist. 8	1,125,000	2,800	1,127,800	1,127,800
Dist. 9	210,000	1,500	211,500	211,500
Dist. 10	104,000	1,000	105,000	105,000
Utah	110,000	.....	110,000	109,300
Wyoming	333,400	.....	333,400	332,600
Others	‡325	.....	‡325	‡325
Total U. S.	6,936,180	182,175	**7,118,355**	§7,199,100
Change from previous week, down			**80,745**	
Canada	†587,800	.....	†587,800	†603,100
Total U. S. production—Jan. 1-Jan. 31				§220,723,400 bbl.
Same period last year (crude plus cond.)				*212,810,022 bbl.

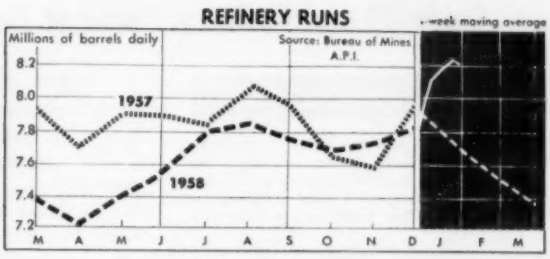
*Includes 4,973,925 bbl. condensate. †Week ended previous Monday. ‡South Dakota, Washington, and Arizona. §Revised.

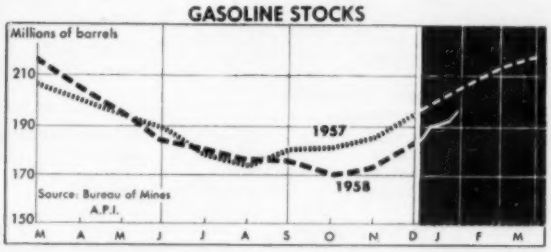
CRUDE-OIL PRODUCTION

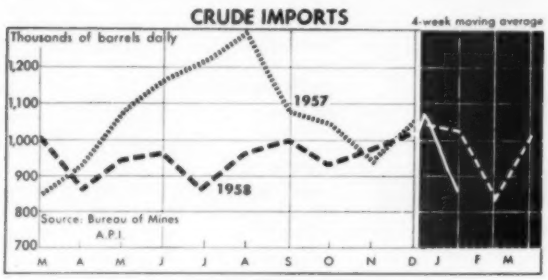
4-week moving average

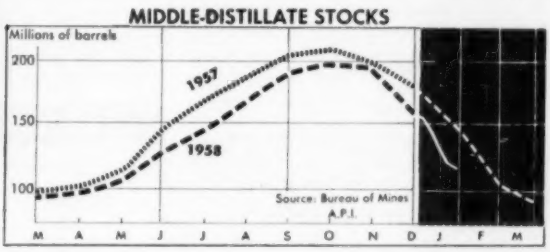


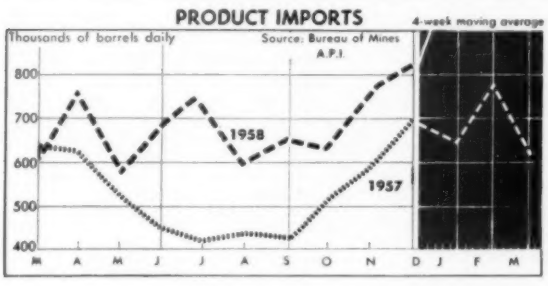

TOTAL DEMAND–ALL OILS
4-week moving average
Millions of barrels daily
Source: Bureau of Mines
O. & G. J.—A.P.I.
1957
1958
M A M J J A S O N D J F M

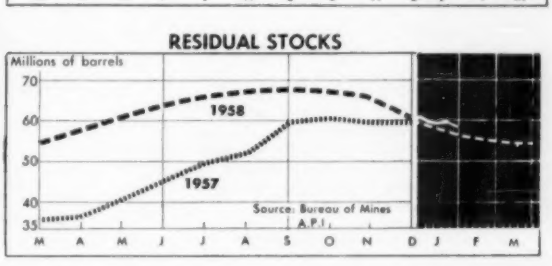












API REFINERY REPORT—JANUARY 30, 1959

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, January 1958 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,201	580.6	59.9	425.6	185.4	43,206	9,634	33,473	11,182	1,151	502.9	35.5	338.9	194.5
Appalachian:														
District 1	81	39.9	4.4	18.4	10.0	4,441	415	2,360	275	99	40.5	4.5	25.1	9.3
District 2	117	56.4	7.0	20.8	19.3	2,818	383	943	232	93	53.4	6.8	17.4	11.1
Ind., Ill., Ky.	1,516	728.7	73.6	390.6	196.7	34,323	4,216	15,646	3,511	1,408	709.1	77.8	322.0	192.2
Minn., Wis., Dak.	107	47.3	5.3	27.0	12.4	6,644	750	4,681	533	109	50.9	5.8	29.1	13.5
Okla., Kans., Mo.	772	410.7	27.1	210.8	43.4	20,358	1,128	8,054	953	736	416.5	17.7	195.3	41.5
Inland Texas	289	204.4	5.9	55.3	21.7	7,977	261	1,804	2,191	277	192.4	11.1	51.3	20.8
Texas Gulf Coast	1,890	841.0	132.6	536.9	212.4	27,074	1,699	9,455	6,207	1,757	870.6	128.8	472.3	206.3
La. Gulf Coast	671	346.6	91.1	178.1	53.0	12,286	1,404	3,732	1,563	596	349.1	55.7	132.2	36.2
N. La. and Ark.	97	40.3	6.1	24.0	4.7	5,482	467	2,192	63	95	38.1	8.4	19.1	9.2
Rocky Mountan:														
New Mexico	24	13.0	0.1	3.4	2.7	609	34	163	35	23	11.3	0.3	4.3	2.7
Other Rky. Mt.	286	139.3	4.4	64.7	35.6	5,937	182	2,510	758	265	124.4	3.9	64.7	37.7
West Coast	1,062	482.4	4.9	183.3	288.4	26,356	337	11,732	30,364	1,063	467.9	5.1	169.1	313.7
Jan. 30, 1959	8,113	3,930.6	422.4	2,138.9	1,085.7	197,511	20,910	96,745	57,867	7,672	3,827.1	361.4	1,840.8	1,088.7
Jan. 23, 1959	8,311	4,014.4	352.1	2,144.1	1,111.3	192,883	21,388	100,402	59,924	.....	.....	.....	.....	.....
Jan. 31, 1958	7,548	3,862.9	355.1	1,791.9	1,071.0	204,599	23,179	123,121	57,502	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):

Regular (89 octane)	11.25-11.625
Premium (99 octane)	14.25-14.625

Gulf Coast (cargoes for coastwise or export movements):

Regular (90 octane)	9.75-10.25
Regular (92 octane)	10.00-10.50
Premium (97 octane)	11.125-11.625
Premium (98 octane)	11.25-11.75

California (rack) (Los Angeles):

★ Regular (88 octane)	12.00-12.60
★ Premium (94 octane)	13.00-14.60
★ Premium (98 octane)	14.00-15.70

Caribbean area (cargoes):

Regular (87 octane)	9.875
Premium (97 octane)	11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:

Grade 26-70	4.5

Breckenridge:

Grade 26-70	4.0

*If 26-70 natural is considered as 100%, prices for lower-vapor-pressure grades increase 2.5% for each unit drop in Reid vapor pressure down to and including 16 lb. Prices for grades below 16 lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):

★ Kerosine 42-44	11.00
★ Diesel oil (58 d.i. and above)	10.75
★ Distillate No. 1	10.75
★ Distillate No. 2	10.00

Gulf Coast (cargoes):

★ Kerosine 41-43	10.375
★ Distillate No. 2	9.875

New York Harbor (barges):

Kerosine 41-43	11.50
Distillate No. 2	11.00
Diesel fuel, 48-52 d.i.	11.25

Caribbean area (cargoes):

★ Distillate No. 2	9.875

WAX (LB.)

Oklahoma (Group 3):

132-135 A.m.p. (semi-refined) in tank car	6.50

New York (export):

126-130 A.m.p. crude-scale (solid in bags or barrels)	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):

Residual fuel (max. 1% S)	$1.95-2.00

Gulf Coast (cargoes):

Bunker C fuel	$2.00

New York Harbor (barges):

Bunker C fuel	$2.37

Caribbean (cargoes):

Bunker C	$2.00

California (rack):

Bunker C fuel, Los Angeles	$2.15

LUBRICATING OILS

Mid-Continent (Group 3):

150-160 bright stock, solvent refined, 0-10 pp., 95 v.i.	23.0
200 vis. neutral oil, solvent refined, 0-10 pp., 95 v.i.	20.5

Pennsylvania Grade:

145-155 vis. at 210, bright stock, 8 color, 25 p.t.	22
200 vis. neutral (180° at 100°), 25 p.t.	21

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Okla-homa*	Gulf Coast Tex.†	★West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$1.86	....	....	....	....
15-15.9	1.95	....	....	....	$1.81
16-16.9	2.04	....	....	....	1.86
17-17.9	2.13	....	....	....	1.91
18-18.9	2.23	....	....	....	1.96
19-19.9	2.32	....	....	....	2.01
20-20.9	2.41	$2.52	....	$2.35	2.06
21-21.9	2.50	2.55	....	2.38	2.11
22-22.9	2.60	2.58	....	2.41	2.16
23-23.9	2.69	2.61	$3.44	2.44	2.21
24-24.9	2.78	2.64	3.46	2.47	2.26
25-25.9	2.84	2.67	3.48	2.50	2.31
26-26.9	2.90	2.70	3.50	2.53	2.36
27-27.9	2.95	2.73	3.52	2.56	2.49
28-28.9	3.01	2.76	3.54	2.59	2.54
29-29.9	3.07	2.79	3.56	2.62	2.59
30-30.9	3.12	2.82	....	2.65	2.63
31-31.9	3.20	2.85	....	2.68	2.67
32-32.9	3.27	2.88	....	2.71	2.71
33-33.9	3.34	2.91	....	2.74	2.75
34-34.9	3.41	2.94	....	2.77	2.79
35-35.9	3.47	2.97	....	2.80	2.83
36-36.9	3.52	3.00	....	2.83	2.87
37-37.9	3.56	3.02	....	2.86	2.89
38-38.9	....	3.04	....	2.89	2.91
39-39.9	....	3.06	....	2.92	2.93
40-40.9	....	3.08	....	2.95	2.95

*Another Oklahoma (sweet) schedule has a top of $3.05 with different gravity variations to $2.34 for below 20°. †Low cold test crude. ‡Sour.

Effective dates of broad changes: California, 1-26-59; East of California, January 3-10, 1957; Pennsylvania Grade 12-22-58.

FLAT PRICES

Louisiana:

Sweet Lake	$3.00
Ville Platte	3.30

Texas:

East Texas	3.25
Conroe	3.53
Van	3.08

Pennsylvania Grade:

Bradford	4.05
Middle District	3.87
Southwest Pennsylvania	3.58
West Virginia	3.40
Buckeye Grade	3.25

Illinois Basin	**3.00**

Canada:

Leduc-Woodbend	2.67
Redwater (Alta.)	2.56
Smiley (Sask.)	2.33
Pembina	2.52

FOREIGN

Venezuela:

Cumarebo, 48°-49.9°, Tucupido	3.66
San Joaquin, 41°-41.9°, Puerto La Cruz	3.25
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tía Juana medium, 26°-26.9°, Amuay*	2.55
Quiriquire, 16.0°-16.4°, Caripito	2.15
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.93

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):

Arabian, 36.0°-36.9°, Ras Tanura	$2.12
Iranian, 34.0°-34.9°, Bandar Masur	2.04
Iranian, 34.0°-34.9°, Ababan	1.99
Iraq, 35.0°-35.9°, Fao	1.98
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.85
Qatar, 41.0°-41.9°, Umm Said	2.23

Middle East, E. Mediterranean:

Arabian, 36.0°-36.9°, Sidon	2.49
Iraq, 36.0°-36.9°, Tripoli, Banias	2.49

Far East (cargoes, f.o.b. Lutong, Sarawak):

Seria Light, 37°	2.75

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-U.S.N.H., dirty (ATRS +17.5%)	$3.35
Carib.-U.S.N.H., clean (ATRS −45%)	1.51
★ Carib.-U.S.N.H., dirty (USMC −62.5%)	1.01
Carib.-U.K., dirty (Scale−50%) (16s. 3d.)	2.28

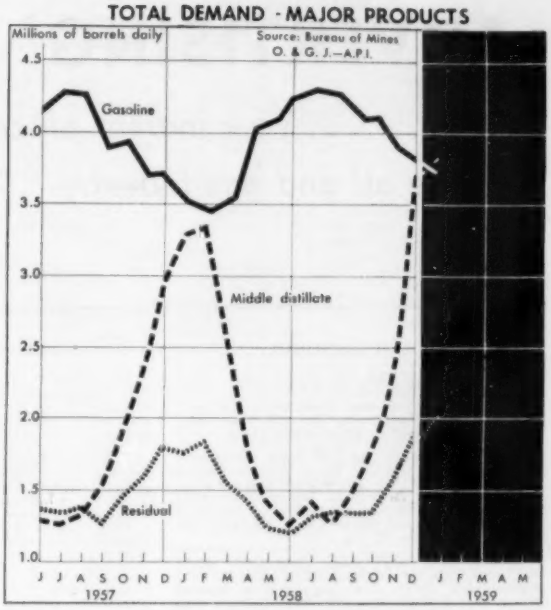
SUPPLY AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

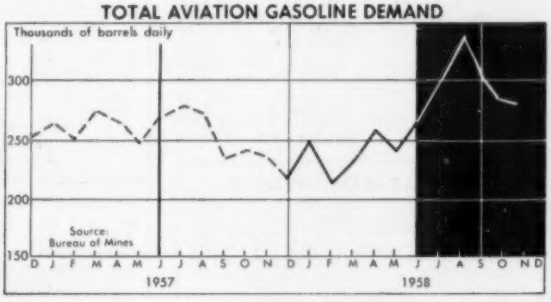
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
January 1959*	3,710	4,105	198,000
December 1958*	3,790	4,100	186,100
November 1958	3,769	4,028	178,574
February 1958	3,485	3,767	215,930
January 1958	3,523	3,827	207,115
KEROSINE			
January 1959*	595	421	20,500
December 1958*	556	375	26,100
November 1958	346	350	32,120
February 1958	594	380	17,202
January 1958	565	361	23,073
DISTILLATE			
January 1959*	3,195	2,115	96,200
December 1958*	3,090	1,980	126,600
November 1958	1,968	1,812	161,192
February 1958	3,001	1,721	87,906
January 1958	2,748	1,841	122,375
RESIDUAL			
January 1959*	2,030	2,535	57,600
December 1958*	1,870	1,045	60,700
November 1958	1,559	979	66,223
February 1958	1,875	1,109	55,095
January 1958	1,791	1,089	57,562

*Preliminary. †Thousands of barrels.

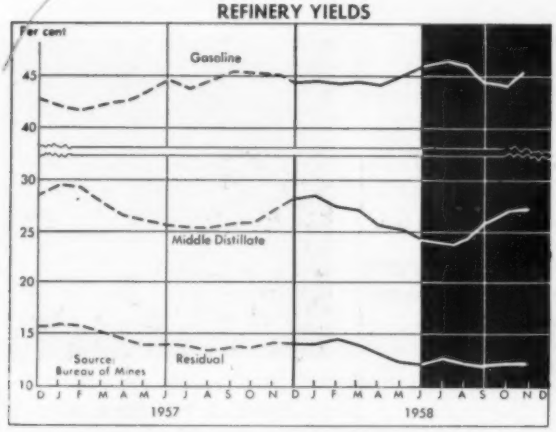
TOTAL DEMAND - MAJOR PRODUCTS



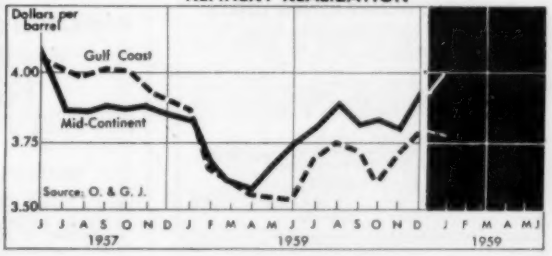
TOTAL AVIATION GASOLINE DEMAND



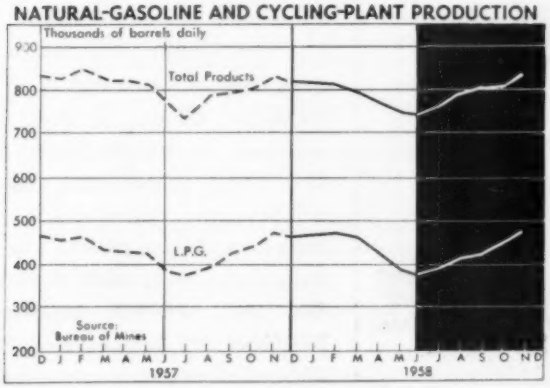
REFINERY YIELDS



REFINERY REALIZATION



NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION



REFINERY REALIZATION

	Jan.* 1959	Dec.* 1958	Nov. 1958	Jan. 1958
Mid-Continent	$3.99	$3.92	$3.81	$3.83
Gulf Coast	3.75	3.78	3.63	3.86

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel, and residual as published in The Oil and Gas Journal.

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ALLIS-CHALMERS, HD11B Tractor, Complete, incl. winch, A-C 11BD Hyd. Bulldozer, hour meter, etc. Used only 100 hrs., like new. H. Waggoner, 1611 SE 25th, Box 4215, Pho. OR 7-6653, Okla. City, Okla.

FOAMITE, American LaFrance Generator Powder, single powder type, original sealed 50 lb. cans, our low price $1.85/can, manufacturers price $3.25/can. Material guaranteed perfect. Foamite Generators, portable, w/hoppers, unused $25.00 each. Wallach, 727 Walnut St., Phila. 6, Pa.

SALES AND RENTALS. Used cable drilling and fishing tools, casing, production equipment; from the Southwest's largest stock of oil field supplies. Degen Pipe and Supply Co., Tulsa.

WELL DRILLS - CORE DRILLS. Everything for well and core drilling in both new and used equipment at money saving prices. Fishing tools rented. Send for bulletins. Pressey & Son, Pueblo, Colo.

FULLY EQUIPPED, shallow oil Rotary Rig mounted on Float. Three Trucks, Pipe Trailer, clean, ready to work. Owing to death of owner this equipment priced to sell. Write for invoice. Mrs. Clarence McFaull, Phone 982. P. O. Box 495, Bastrop, Texas.

FOR SALE—COMPRESSOR.

OILWELL Model DGE-175 Duplex with accessory equipment. Skid mounted. Two 4¼"x11" double acting cylinders for single stage operation. Waukesha Model 6-NKRU 72 x 8¼" gas engine. Located in Pennsylvania. For price and complete details write

Box L-175, The Oil and Gas Journal, Tulsa, Oklahoma.

ELECTRIC GENERATING UNITS

7—400 H.P. Cooper-Bessemer Type GN8G STB, size 11½" x 13½" @ 400 R.P.M. direct connected to
7—250 KW General Electric Type AT-1-18-312-400, 3 phase, 60 cycle, 4160 volts, .8 P.F., 400 R.P.M., Form A Electric Generators. Belted to 7 120 volt DC Excitors.

Used Condition—Parts for Above
Priced attractively for quick sale from Hardin City, Oklahoma.

C. J. SMITH
305 Oil Capitol Bldg., Phone LUther 3-5516 Tulsa, Oklahoma.

FOR SALE

Near Rodessa, Louisiana—3 B & W Sterling boilers, 192 B.H.P. 200# W.P. each, complete with breeching, 120' stack, firing controls, relief valves, etc. Includes structural steel and open sided steel covering, boiler feed pumps. Brick work has been dismantled. Other items of distillation type gasoline plant equipment; some Worthington and Clark compressor cylinders. Write or call

Glen Rose Gasoline Company,
314 Fairfield Building,
SHREVEPORT, LOUISIANA,
or call R. E. Perry, telephone No. 2-3630, Shreveport, Louisiana.

FOR SALE EQUIPMENT

SACRIFICE Ingersoll-Rand 4-XVG 150 h.p. Compressor. Complete installation including 20' x 22' building. Guaranteed new condition. P. O. Box 1413, Corpus Christi, Texas.

USED PIPE AND USED TANKS—For Sale. Rogers & Wright, Incorporated, 216 West Second Street, Tulsa, Oklahoma; 710 Peoples Building, Charleston, West Virginia.

FOR SALE—2 Ingersoll-Rand XVG-6 gas engine compressors. Also one Clark RA-4; 2 Clark RA-32. Box L-155, The Oil and Gas Journal, Tulsa, Oklahoma.

GR G-FIN Tank Heater, Size 27-2462, Two 12x10x18 Duplex Reciprocating Hot Oil Pumps, Steel Fluid Ends, Howe Propane Compressor, Wittenmeir Hydrogen Compressor. A. R. Motheral, Box 14306, Houston 21, Phone JA 3-2189.

NEED PIPE?

8" Steel, Wt. 28 lbs., beveled for welding, straight machine cleaned, coated, strictly No. 1 grade. Pittsburgh Testing Lab. report furnished.

Indiana-Ohio Pipe Co.
P. O. Box 323 Phone 3-4674
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FOREIGN DRILLING—8,000-10,000 FT.

$475,000 buys five complete rotary rigs, A-1 condition, Cardwell Drawworks, all alike, three now drilling. All in U.S.A., immediate delivery.

Cardwell Investment Company, Inc.,
804 Petroleum Building; Phone AM 5-2611; Wichita, Kansas

We Own the Equipment We Advertise!

Compressors

1—Clark RA-4
5—IR XVG-6, XVG-4
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10—Steel 3200—200 sq. ft.
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8'x38' 10 Tray 480#
4'x50' 12 Tray 450#
3¼'x57' 10 Tray 250#
8'x75' 20 Tray 25#
5'x96' 40 Tray 135#
2'x45' 24 Tray
18"x32' 15 Tray 160#
4½'x17' 500#
12'x43' 25#
5 Packed Towers 12"—24"

BRILL EQUIPMENT COMPANY
4101 SAN JACINTO ST., HOUSTON 4, TEXAS, JA 6-1351
2401 THIRD AVE., NEW YORK 51, N. Y., CYpress 2-5703

FOR SALE EQUIPMENT

1500 FAILING Heavy Duty, Mayhew 1000, 71 Star, all complete. Drilling Service Diamond core barrel. Bucket auger rig, 36" table. Fred Butler, Box 481, Pueblo, Colo.

CRANK SHAFTS AND BEARINGS for HMA-6 Clark compressors. Also packaged and stationary gas compressors. Alfred B. Kern, 305 Kennedy Building, Tulsa, Oklahoma.

GAS ENGINE COMPRESSORS

3—230 H.P. Cooper-Bessemer Type 12 Horizontal Twin Gas Engine Compressors complete. Direct connected to 14½" x 20", 10½" & 6" x 20" compressor cylinders for three stage operation.

Used Condition—Priced Attractively. Prompt Shipment from Hardin City, Oklahoma.

C. J. SMITH
305 Oil Capitol Bldg. Phone LUther 3-5516 Tulsa, Oklahoma

13,750 KVA POWER PLANT. STILL INSTALLED. Will be sold as complete unit or piece by piece. Consists of (11) 1250 KVA Rathbun-Jones Natural Gas Generator Sets. **ENGINES**—1430 HP, 8 Cylinder, 4 Cycle, 300 RPM, direct connected to **GENERATORS**—1250 KVA, .8 PF, 3/60/2400-4160. Complete with Switchgear. Can be seen in operation on foundations. **PRINTS** and Photos available. Write **HEAT & POWER CO., INC., POWER EQUIPMENT DIVISION,** 310 Thompson Bldg., Tulsa, Okla.

EQUIPMENT WANTED

SMALL CABLE AND TOOL RIG. Send inventory and price to T. J. Wilson, Bardwell, Ky.

WANTED TO BUY—Amerada B H P Equipment. State condition, price, and location. Box L-187, The Oil and Gas Journal, Tulsa, Oklahoma.

13⅜" RECEDING HEAD Landis Pipe Threader with Lead Screw and taper attachment. Box L-163, The Oil and Gas Journal, Tulsa, Oklahoma.

600 TO 800 HP Natural Gas Engine with or without compressor cylinders. Box L-149, The Oil and Gas Journal, Tulsa, Oklahoma.

TWO 5x8 SLUSH PUMPS or 6x12 or 7½x8. Must be late models and in good shape. Send complete information and price to Hare Equipment Co., 2018 W. T. Waggoner Bldg., Ft. Worth 2, Texas.

POWER PIPE straightener and Dee Denter for 8" Pipe. Ind.-Ohio Pipe Co. P. O. Box 323, Decatur, Ind.

HELP WANTED

FOREIGN EMPLOYMENT: Lists about 40 U. S. oil companies, 30 drilling contractors, operating abroad, showing where apply foreign jobs. $5 cash. OIML Co. Box 2803, Tulsa, Okla.

CABLE TOOL DRILLERS. State age, height, weight, companies worked for, rigs run and size of some holes drilled in the past ten years. Only competent, steady and non-drinking drillers need apply. Steady work. Good wages. Benefits. Write to Layne-Northwest Company, 6005 West Martin Drive, Milwaukee 13, Wisconsin.

REFINERY ENGINEERS

Progressive independent refiner (13,500 BPD) offers excellent opportunity for young chemical engineer. Modern plant located in the heart of a growing petroleum area. Some experience required. Send resume and salary requirements to:

Personnel Manager
Lake Superior Refining Co.
Superior, Wisconsin

HELP WANTED

TRANSLATORS. Proven ability to translate technical material into fluent English essential. Attractive full time or free-lance arrangement. All languages of interest, particularly Russian. Send resume to A.T.S., Inc., Drawer 271, East Orange, New Jersey.

POSITION OFFERED—Wanted geophysicist by important European geophysical company. Located in Algiers. Job consists of establishing and maintaining contact with U. S. clients technically and commercially, and securing business. Applicant must have long field and office experience. Mail qualifications and experience to Box L-126, The Oil and Gas Journal, Tulsa, Oklahoma.

MAINTENANCE SUPERINTENDENT

for independent refinery in north-central U. S. Requirements include thorough experience and demonstrated ability in planning and field supervision of refinery or petrochemical plant maintenance or construction. Excellent opportunity for mature energetic man. Attractive living conditions. Salary open. Reply to: George Armistead & Co., 1000 Connecticut Ave., Washington 6, D. C.

PETROLEUM ANALYST—Graduate chemist or chemical engineer with experience in a refinery or petroleum research laboratory wanted by a research corporation located in Florida, to perform analysis and treatment of crude oil, and research and development work on new equipment. Salary commensurate with experience and background. Excellent opportunity. Send photograph and complete resumé of experience, education, and salary requirements to Box L-147, The Oil and Gas Journal, Tulsa, Oklahoma.

VENEZUELA

Chief Petroleum Engineer

Established Venezuelan producing company offers excellent career assignment as manager of production and reservoir engineering section. Salary, living allowance, bonus, medical, schooling, retirement and other benefit plans. Candidates must speak Spanish fluently. Send resume to either Dallas or Philadelphia.

The Atlantic Refining Co.

P. O. Box 2819, Dallas, Texas, Attn.: G. O. Wheeler
P. O. Box 7258, Philadelphia, Pa., Attn.: W. A. Sooy

HELP WANTED

INSTRUMENT ENGINEER for foreign work that has had actual plant experience at a petroleum refinery or chemical plant. Must be able to organize and develop instrument department. Send chronological resume to Box L-181, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEER to act as foreman for laboratory involving operation of large scale petroleum and petro-chemical pilot plants. Laboratory located in New Jersey. Send complete chronological resume to Box L-182, The Oil and Gas Journal, Tulsa, Oklahoma.

SALESMINDED, qualified and experienced engineer for design of dehydration, high pressure separation, oil emulsion treating and oil production testing equipment. Salary is open and commensurate with qualifications. Selected man will be based in Tulsa. Some traveling. Write full particulars regarding work experience and personal history to The Hoil Company, Box 5372, Tulsa, Okla.

DISTRICT SALES ENGINEER

Aggressive and expanding corporation needs sales engineer with experience in gas dehydration, cold separation, and treating equipment. Previous selling experience not required. All replies strictly confidential. Send complete resume to:

Graver Tank & Manufacturing Co.
P. O. Box 546 Sand Springs, Oklahoma

PETROLEUM REFINERY CHEMICAL ENGINEERS

APPLIED MATHEMATICIANS

For expanding technical activity engaged in consulting-type service to petroleum refiners. Positions involve a wide variety of projects in sales, research, refining, and company management. Excellent opportunities for persons with either or both of the following backgrounds:

A few years of refining industry experience in process engineering or economic analysis.

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These positions afford professional contact with refining and process companies throughout the petroleum industry, and provide opportunity for using initiative and individual expression to increase responsibility. Detroit suburban location.

Send Resume To:
PERSONNEL MANAGER
ETHYL CORPORATION
1600 W. 8 Mile Road
FERNDALE 20, MICHIGAN

SALES ENGINEERING MANAGER

for

RW-300 COMPUTER CONTROL AND DATA-LOGGING SYSTEMS

The Thompson-Ramo-Wooldridge Products Company is seeking a highly qualified sales engineering manager to direct sales engineers serving the petroleum refining, chemical manufacturing, and other process industries. Knowledge of these industries and of digital computers is desirable. Sales engineering and supervisory experience, as well as a degree in physics or electrical, electronic, or chemical engineering, is required.

Please write, describing experience and education, to **Mr. Raymond E. Jacobson,** Director of Marketing.

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Foreign Drilling Superintendent
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Must be thoroughly experienced to work in Desert Area of North Africa. Give full references and experience background.

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The Oil and Gas Journal,
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Los Angeles 8, California

HELP WANTED

SAFETY ENGINEER—we need an experienced Safety Engineer that is able to organize and develop a safety program for a new large chemical plant. Assignment will be foreign and at first will be on a single-status basis. Please furnish complete resume of experience to Box L-178, The Oil and Gas Journal, Tulsa, Oklahoma.

ASST. MAINTENANCE ENGINEER to assist the maintenance engineer. Man selected should be a graduate engineer with five years refinery experience, three of which should have been as a maintenance foreman or in a responsible maintenance position. Salary commensurate with experience. Send resume to Box L-189, The Oil and Gas Journal, Tulsa, Oklahoma.

MAINTENANCE ENGINEER to take complete charge of the maintenance department of an expanding 17,000 Bbl./d. modern refinery. Man selected should be a graduate engineer with seven to ten years refinery or petrochemical experience, four years of which should have been in a responsible maintenance or construction position. Send resume to Box L-185, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING MUD SALESMAN—Gulf area Supervisory capacity, excellent opportunity for a man who is well acquainted with the purchasing personnel and end users of Barite. We own and operate our own domestic quality controlled mine. Our product is industry accepted. Salary and bonus. Send complete resume so that interview can be arranged. Our employees know of this ad. Box L-190, The Oil and Gas Journal, Tulsa, Oklahoma.

RADIOACTIVITY Logging Operators with perforating experience openings in Oklahoma and Kansas. Jetwell, Inc., 932 Mayo Building, Tulsa, Oklahoma.

SITUATION WANTED

GEOLOGIST desires position as Geologist, B.S. 1958, no experience, age 26, married, one son. Willing to learn and travel—Wallis Perry, 1910 Howard—San Antonio, Texas.

DUE TO CURTAILMENT in refinery personnel the following men are available: Shift Foreman, Yield Clerk, Safety Engineer, Maintenance Foreman, Warehouseman and Engineer-Draftsman. Box L-151, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION—pipe line gathering system supt. 23 yrs. practical experience and operation desires responsible connection with progressive independent. Excellent references. Box L-157, The Oil and Gas Journal, Tulsa, Oklahoma.

PIPELINE ENGINEER: Graduate mechanical. Ten years pipeline experience; products and gas. Desires responsible position with established company in U. S. Box L-137, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, 30, M.S. 3½ years experience Mid-Continent. Desire position with opportunity for responsibility and advancement. Box L-167, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY ACCOUNTANT—Six years refinery experience, 3 years Chief Accountant—light oil and lube. Three years C.P.A. experience. Degree. Age—37. Married. Best references. Box L-169, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED TRANSLATOR—Scientific Russian translated with speed and accuracy. Have specialized for four years in fields of Geology and Chemistry. Box L-171, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, M.B.A. Seeks Sales Engineering job. Four years experience in engineering and sales work. Will relocate. Box L-176, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST, 8 years experience. Last position held Geophysical Supervisor. Foreign experience. Prefer foreign—domestic acceptable. Box L-181, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTORNEY-GRADUATE ENGINEER, 34, desires legal or executive position. Presently employed in oil and gas. Accustomed to high level negotiating. Box L-166, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATION WANTED

PRODUCTION - EXPLORATION - MANAGEMENT—Oil and Gas, West Central & South Texas. 6 years Independent Producer and Consultant. 2 Years Chief Geologist and Engineer. Land, Gas purchasing, Contracts. Excellent references. Desires position with well financed aggressive Independent or Investment Syndicate. Box L-164, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPLORATION GEOLOGIST, 40, family, 11 years experience, 3 majors, 6 years with active Independent, 2 consulting, oil-finding record. Have worked Permian Basin, Panhandle—North and West-Central Texas, 4-Corner, Uinta and Western Kansas. Prefer established, aggressive Independent who rewards success. Box L-172, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATION WANTED

SALES AGENT: Mechanical Engineer with wide chemical processing experience wants to represent manufacturer of processing or mechanical equipment in Tulsa area. Box L-179, The Oil and Gas Journal, Tulsa, Oklahoma.

SENIOR GEOPHYSICIST — 34, married, fifteen years domestic and foreign experience with contract firm and major oil company, requires position domestic or foreign. Presently employed but will consider all offers. Box L-185, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST—twelve years experience as Party Chief and Supervisor. Available now. Box L-186, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASE AND DRILLING BLOCKS

IT'S TOO LATE NOW

To acquire oil leases in Green County, Kentucky area for the usual one dollar per acre. Lease sale prices have topped $3,000 per acre during the past 30 days. Asking price for one 157 acre tract with three wells (under 600 feet deep) is $450,000. This is the biggest Appalachian Basin Boom of the past 40 years.

We believe—that the stage is quietly being set for a repeat performance in the Appalachian theatre of operations—that the real sleeper to watch now is Northeastern Ohio—that another Boom, with soaring lease prices, will break loose here before 1959 ends. See The Oil and Gas Journal pages 119 to 122, issue of Jan. 12, 1959.

More than one million acres already leased. Biggest names in the industry —including members of the "Big 10"—have moved in on 25,000 to 100,000 acre blocks, and are negotiating for more land.

We have blocks of all sizes available—from 100 to 100,000 acres—at LOW prices. Ten year leases—no drilling commitments.

Box L-174, The Oil and Gas Journal, Tulsa, Oklahoma.

450 ACRES, 6-20-12 Barton County, Kansas for ⅛ override and test well. David Fransen, 145 S. Pershing, Wichita, Kansas.

WANT SHALLOW ACREAGE for three well test program, offset or extension, preferably farmout. Write U. S. Anderson, 8350 Santa Monica Blvd., Los Angeles 46, California.

FOR SALE—Government 40 acre oil leases in Arizona, N. M. & Calif. You do no drilling yet. You share in fortunes made from oil on public lands. Payments if desired. Free information & maps of booming areas. Bids now accepted via mail. Universal Investors Corp. 30 W. Washington Street, Chicago 2, Illinois.

LIVE-WIRES WANTED. 350 Acres Available in Green County, Ky. For immediate Leasing & Drilling Write Box L-184, The Oil and Gas Journal, Tulsa, Oklahoma.

⅛ INTEREST in 40 acre offset to production five hundred seventy-five feet well, Sorona sand. Well ready to drill—Box 628—Okmulgee, Oklahoma.

GREEN COUNTY, KENTUCKY Boom Area Leases—in fairway, 4400 acres in large or small blocks. Some direct offsets or close to production. Low lease costs for immediate drilling deals. Write for full particulars. Box L-183, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE—Minerals in Montana portion Williston Basin. Howard Helmer, Box 385, Poplar, Montana.

4000 ACRES of oil and gas leases in San Miguel, San Doval, Torrance, Lincoln, Chavis and Debaca counties, New Mexico. Also, one section of mineral lease in Santa Fe County. All are for out right sale or drilling contract. Full description or photostatic copies furnished on request. Write Box L-180, The Oil and Gas Journal, Tulsa, Oklahoma.

3 WELLS TO BE DRILLED

BY MAJORS IN KANSAS

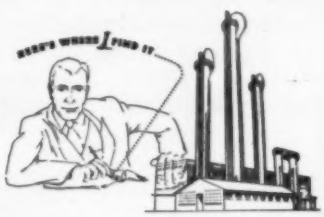
All in Different Sections
Four Acres or Royalty Under Each Well.
$1,000.00 for all.

Jim Nix
Box 3041, Okla. City, Okla.

ROYALTIES

HIGHEST PRICE PAID for oil and gas income royalties, overrides, oil properties. A. S. Berry, 109 Midco Bldg., 302 South Cheyenne, Tulsa, Oklahoma.

Can You Help This Man?



It's a good bet that you can!

Actually he's a lot of men. Men that have jobs to fill or want a new position; equipment to buy or sell; production, acreage, leases, or real estate to sell or buy; or a business opportunity. He may be looking for your services, maps, or field records.

Why Not Tell Him You Have What He Wants With

A JOURNAL CLASSIFIED

The cost is reasonable:—26¢ per word or $18. per Col. in. Minimum $5. for word ads, 1 in. for Display. 10% reduction for three consecutive insertions of the same copy. (This ad is 1 col. wide and 5 in. deep.)

For assistance on classified ads, write

THE OIL AND GAS JOURNAL
P. O. Box 1260 — Tulsa, Okla.

WANTED

WANT TO BUY from individuals or companies waste oil of any kind in any amount. Inquiries to Red River Oil Purchasing Co., Box 68, Kingston, Oklahoma.

FELLOWSHIP AVAILABLE

GRADUATE FELLOWSHIPS in petroleum engineering starting September 15, 1959. Stipends from $800 to $1800 plus tuition. Reply, Graduate Advisor, Department of Petroleum Engineering, University of Texas, Austin, Texas.

BUSINESS SERVICE

Delaware Corporations formed and serviced. American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

PRODUCTION WANTED

WANTED PRODUCTION OIL OR GAS not to exceed $500,000.00. We are the purchasers, best of banking references. Your correspondence will be treated in strict confidence. Box L-173, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Oil properties. 100 to 5,000 barrels daily in Oklahoma and Kansas Morris Sitrin, P. O. Box 1186, Tulsa, Okla

UNLIMITED FUNDS for purchase of oil and gas properties or producing company in North, West, West-Central Texas. Negotiations in strictest confidence. Box 743, Abilene, Texas.

REAL ESTATE

SHEEP RANCH FOR SALE—7600 acre Sheep Ranch in the San Luis Valley in Colorado, with summer range permit for 3,000 head. $30.00 per acre; ½ of minerals reserved. Clifford Burnham, Real Estate, Saguache, Colorado. Phone—OLympic 5-2611.

SUB LEASE

Desirable Office Space Downtown Houston. 642 Square feet—Three large, one small air conditioned offices.

MELLIE ESPERSON BUILDING
Contact L. V. RIST
P. O. Box 8444 Telephone ID 3-2421
Houston 4, Texas

BUSINESS OPPORTUNITIES

NEW SERVICES WANTED

Well-established service company with facilities and personnel desires additional services or products to distribute to the oil industry in Lower Texas Gulf Coast.

Box L-177, The Oil and Gas Journal, Tulsa, Oklahoma.

MONEY RAISING

READY TO DRILL 160 acres 800 ft. Peru sand. Good for water flood after flush production. Looks good for small investment. Box 2882, Wichita, Kansas.

310 ACRES OFF-SET to lime production 1,700 ft. deep. Need some drilling capital. Box 2882, Wichita, Kansas.

FINANCIAL CONTACTS, Underwriters, Brokers, Private Finders of Capital reached. No shopping. Confidential. FREE ENTERPRISE ASSOCIATES, 817—51st St., Brooklyn, N. Y.

AIRCRAFT

FOR SALE

Bell 47H-1 Helicopter
Bellairus Executive Model.
$35,000.

Write:

Signature Homes
8228 Wilshire Blvd.
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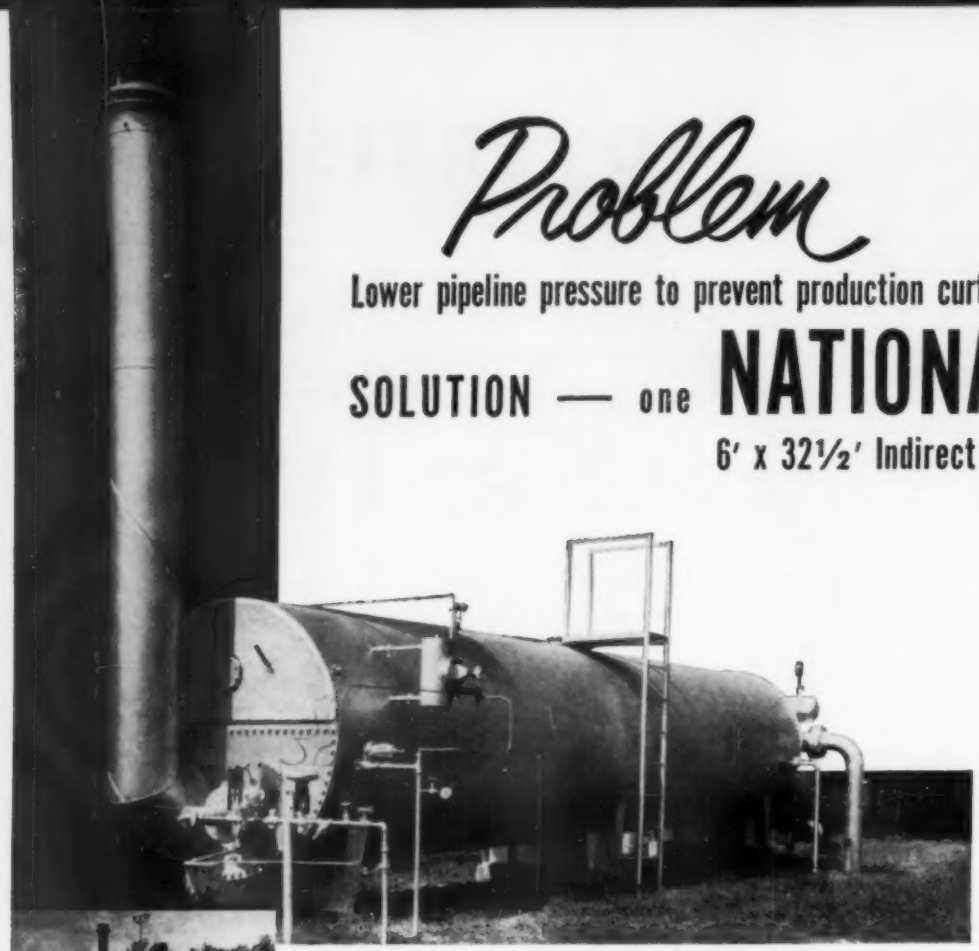

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